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British Society for the History of Pharmacy
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British Society for the History of Pharmacy

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The British Society for the History of Pharmacy was formed in 1967 under the aegis of the Pharmaceutical Society of Great Britain, having originated from its History of Pharmacy Committee.

BSHP seeks to act as a focus for the development of all areas of the history of Pharmacy, from the works of the ancient apothecary to today's ever changing role of the community, hospital, wholesale or industrial pharmacist. Membership is open to all interested in the aims of BSHP.

Aims

Promotion of historical studies related to pharmacy.
Advancement of knowledge and propagation of understanding of the history of pharmacy.
Publication of the research work of pharmaceutical historians.
Preservation of pharmaceutical artefacts and historic pharmacies.
Support for the work of relevant museums and offering advice on establishment of other pharmaceutical exhibits and on the preservation of pharmacies.
Co-operation with related professions and local historians on medico-pharmaceutical topics of mutual interest.

Pharmaceutical Historian

The *Pharmaceutical Historian* has been published since 1967, at first intermittently, but on a regular quarterly basis from 1972. Issues generally comprise 16 or 20 pages and cover.

An **index** for the years 1967-1995 was published in 1998, for 1996-2000 in 2000, for 2001-2005 in December 2005 and for 2006-2010 in December 2010. They can be viewed on the website.

Papers, short communications and letters in English on any aspect of the history of pharmacy are welcome and should be sent to the address above or by email to *ainley.wade @easynet.co.uk*

Any illustrations are converted to monochrome for printing. Further details of requirements can be found on the website *www.bshp.org* under Publications.

Membership

Membership costs £20.00 per annum and includes:

Four issues of the *Pharmaceutical Historian*.

Regular meetings, with guest speakers, usually in November, February and May.

Visits to places of historic interest, museums, collections, botanical gardens, etc.

Annual Conference, usually in March/April.

Free use of the Royal Pharmaceutical Society of Great Britain's library facilities for research.

Help in historical research and with the identification of artefacts.

Affiliation to the International Society for the History of Pharmacy (ISHP).

Affiliation to the British Society for the History of Medicine (BSHM).

Application forms are available from the Honorary Secretary at the address above or on *www.bshp.org*

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Diary

Please note that from May the evening, unless otherwisw stated, meetings will be held at the RPS, 66-68 East Smithfield, London E1W 1AW, starting with refreshments at 5.00 pm. The RPS is expected to have moved to its new headquarters by May 2015.

Monday 18 May 2015
Joint meeting with the Friends of the Archives, Society of Apothecaries to view displays of the Museum of the RPS **at its new headquarters** at **66-68 East Smithfield, London E1W 1AW. Refreshments at** 5.00 for 5.30. Details with the meeting notice.

Monday 12 October 2015
'Joseph Banks' by Andrew Sankey. At new RPS headquarters at 58 East Smithfield, London E1W 1AW, 5.00 for 5.30.

November 2015
Joint Meeting with Medway School of Pharmacy. Details to be confirmed.

British Society for the History of Medicine, 26th Congress 2-5 September 2015, Leeds

The congress will be held at Weetwood Hall, Leeds on the themes 'The good, the bad and the unknown (people, events and discoveries)' and First World War Medicine. Preliminary information is available at http://www.bshm.org.uk/Congress.asp?ID=5

BSHP Conference 2015

The 2015 Conference will be held from Friday 27 March to Sunday 29 March in Sunderland. The cost will be held at £300, as last year.

The Conference will be at the Best Western Roker Hotel, Roker Terrace, Sunderland, Tyne And Wear, SR6 9ND. This is a sea front hotel about 1 mile from the city centre. There is no pre-arranged activity for Saturday afternoon.

The main theme will be '*The Apothecary*' to commemorate the Apothecaries Act of 1815. Pharmacy student
Laura Ghiggino, will give the Burnby Award Lecture on 'Medicine in 1914' and there are papers on Sunderland and New Zealand, as well as posters. Enquiries or requests to provide posters to Shirley Ellis as soon as possible please: shirleyellis@shirlellis.plus.com

International Congress for the History of Pharmacy, Tuesday 8 to Friday 11 September 2015, Istanbul, Turkey

The 42nd International Congress will be held at the Istanbul University Convention Center on the theme of the 'Exchange of Pharmaceutical Knowledge Between East and West'. Further information and booking forms are available at www.42ichp.org.

International Society for the History of Pharmacy
The 2014 ISHP newsletter is available at
www.histpharm.org/IGGP%20Newsletter_15_2014.pdf

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A Survey of Artificial Pharmaceutical 'Stones' – Part 1

Christopher J Duffin and Rachael Pymm
Sutton, Surrey and Egham, Surrey

Rocks, minerals, fossils and earths have a history of use in the lapidary traditions of all the major world civilisations, from classical times extending, in some cases, to the present day.[1] In addition to these geopharmaceuticals, a significant number of 'stones' or calculi of various descriptions, some real and some fabulous, harvested from the bodies of living organisms figured in the prescribing practices of European apothecaries and physicians, as well as having a prominent position in folk medicine; bezoar stones are a good example.[2] A third group of hard, durable materials that have been used therapeutically includes artificial or synthetic 'stones' that have been produced as part of the apothecaries' art. This paper seeks to give an overview of these preparations, some of which were the wares of mountebanks and quacks, and others of which were incorporated into official pharmacopoeias.

Lapis de Goa

The Lapis de Goa or 'Goa Stone' was a popular artificial stone invented by the late 17th century Jesuit missionary to Goa, Gaspar António (c. 1531-1610), in response to declining availability and quality of local bezoar stones. The Goa Stone was made up of musk, oriental bezoar, ambergris, red and white coral, emerald, topaz, ruby, sapphire, jacinth, small pearls, fossil shark's teeth, terra sigillata, stones from Cananor and calcined deer horn. These materials were comminuted, mixed into a fine paste, and then coated with a layer of gold leaf. A more detailed history of this artificial stone has been provided elsewhere.[3] Prescribed as an alexipharmic (antidote against poisons), sudorific (sweat inducer), diaphoretic, cardiac tonic, mild astringent and a general cordial or invigorant, it was commonly used to treat a wide variety of fevers, including those associated with plague and gout, as well as being employed in the treatment of small pox, measles, fevers in children, and muscle spasm. The costly nature of the individual ingredients made the Goa Stone an expensive therapy; this obviously made it worth selling counterfeits, as the presence of fine-grained sandstone replacements in John Burges' late 18th century materia medica collection indicates.[4]

Other Bezoar Substitutes

The high cost of importing bezoar stones from India and south-east Asia resulted in the production of artificial substitutes. Two types of Mineral Bezoar appeared during the 17th century. The first was naturally occurring and sometimes referred to as *lapis bezoar fossilis*, *lapis bezoar minerale siculus*, *terra sicula* or Sicilian earth. The Sicilian Cistercian botanist, Paolo Silvio Boccone (1633–1704), commented in 1669 that the 'professors and curious of Sicily' had long used large, white or grey, walnut-shaped stones with internal layering for 'Malignant fevers, Smallpox, Worms, as a Medicament against disease proceeding from rot or from excessive fermentation of the blood'.[5]

The second type was entirely artificial; Pierre Pomet (1658-1699) indicated that Mineral Bezoar was 'made of Butter of Antimony, prepar'd with Spirit of Nitre' – following distillation in a retort, the white residue was then calcined.[6] Possibly the invention of the supposed 15th century alchemist, Basil Valentine (c. 1394-1450), this preparation was esteemed as a diaphoretic.

The closely related Jovial Bezoar (Bezoar of Jupiter or *Bezoardicum joviale*), was also antimony-based, involving the melting of regulus of antimony (purified antimony) with tin and 'corrosive sublimate' (mercuric chloride) and then distilled to make a butter-like material. This was then dissolved in Spirit of Nitre (nitric acid) and distilled further. The remnant was dried to form the Bezoar, which was later powdered, washed and diluted in Spirit of Wine (aqueous solution of ethanol) before being administered, like the very similar *Antihecticum poterii*, against diseases of the lungs, liver, uterus, smallpox, gonorrhoea, apoplexies, epilepsy, 'dimness of sight', giddiness, jaundice, dropsy and ulcers – all conditions that were believed to be eased by inducing copious perspiration.[7] *Bezoardicum lunale* (Bezoar of the Moon) was prepared in a similar way, but with fine silver replacing the tin; it was ascribed similar diaphoretic properties.

Moraccolocius Stone

The Moraccolocius Stone, and the three subsequent artificial stones described below, is the subject of a single-sided pamphlet or broadside dated October 24th 1622 and issued by 'Professor' Iacobus Maximinus, undoubtedly a pseudonym;[8] these stones do not seem to be mentioned in any other contemporary literature. Headed with an impressive crest and surrounded by an ornate decorative border, the sheet was probably an advertising leaflet produced by a mountebank or quack; an extensive search for further publications under this name has proved unfruitful. The author signs himself as 'your loving friend'. The only physical details provided for the Moraccolocius stone is that it was white in colour. Scrapings of the stone dissolved in white wine were recommended as a gargle for 'canker in the mouth or throat, and all evils that come of Blood or rhewme'; three applications were deemed sufficient to give relief ('with God's helpe'). When powder from the stone was dispersed in half a pint of beer or ale, it was supposedly 'good for a stopping, or a stuffing in the stomack with any kind of flegme or glart, or heart-burning or heart-aking', where glart is an archaic synonym of phlegm, one of the four humours. In addition to this, the stone could be used to treat toothache, 'and all rotten and stinking teeth'; the patient was encouraged to put the stone into the hole or aching tooth, allowing it to 'bring forth the worm and the rhewme', by which action it 'maketh the mouth sweete'. The reference to bringing forth worms refers to the long-held belief that small gnawing worms inside the teeth caused dental caries and periodontitis. Dating back to the 'Legend of the Worm' recorded in 5000 BC on an ancient Sumerian clay tablet, this idea is remarkable for its inclusion in the medical beliefs of a wide range of cultures – from China, India, Japan and

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Egypt. In Europe, the idea can be traced back to Scribonius Largus (dates unknown, but 1st century AD), who was Court Physician to the Emperor Claudius, who he accompanied to England in 43 AD. In his book *De compositione medicamentorum*, which contains a list of 271 prescriptions, Largus recommends 'fumigations made with the seeds of hyoscyamus scattered on burning charcoal', followed by rinsing the mouth in hot water in order to expel the tooth worms.[9]

Safonya Stone

This 'famous ... straw-coloured stone' was recommended for podiatric problems thus:

> it is very good for the cornes in your foete and eares, soaking your cornes in warme water and then pare them, and shave some powder of the stone, and it helps them sodainly, the powder being layd thereto.[10]

Permission to sell a variety of topical preparations was granted in 1542 to 'every person being the king's [i.e. Henry VIII's] subject having knowledge and experience' of medicinal simples, provided they charged for ingredients only (and not for consultation). Such people could 'practice use and minister in and to any outward sore, wound swelling or disease'. This became known as the 'Quack's Charter' and led to exorbitantly high prices for individual drugs.[11] Supposed cures abounded for common ailments including corns and ulcers.

The Safonya stone was also recommended in this pamphlet as being effective against dermal parasites:

> Make this stone into powder, and mixe it with Oyle of Bayes, and it will kill the itch, and make no Lice shall trouble any one if the body be anointed therewith. These stones of have beene proeuved, and have holpen many one in this Citie of London'.

Amothist Stone

The third stone advertised by Maximinus is described as being red in colour. The name is remarkably close to that of the purple-hued variant of quartz, whose colour is due to iron impurities, and sometimes the presence of transition elements in the crystal lattice. Before appreciable reserves were discovered in South America, and Europe began receiving shipments during the 16th century, amethyst was counted as being a precious stone, almost on a par with diamond, being produced mainly in Sri Lanka. It was believed to be particularly effective against intoxication and drunkenness, either taken in powdered form or worn prophylactically as part of a finger ring. Additional benefits were believed to be its properties as an astringent, and in helping to treat haemorrhage[12] (probably by sympathetic magic, on account of its range of colours). These therapeutic applications differ considerably from the claims made for Amothist, which was deemed to be

> good for the paine in the huckle bone [an archaism referring variously to the hip bone, astragalus or knuckle], or shins, take the stone, beat it to powder and mixe it with Swine grease, and anoint it by the fire very well, and it is present helpe, it takes away the paines and swellings'.

Alternatively, this ointment could be treated as a 'plaister' which, when laid on the stomach or navel, especially in children, 'brings away the Wormes, both Chest-wormes and other, in four and twenty houres'.

In addition, scrapings of the stone dissolved in four spoons full of water could be snuffed into the nostrils or held in the mouth. The patient was then commended to 'let the rhewme voyd out' in order to ease headache, sore eyes, hearing problems and 'the Megrim'.[13] The latter term is a late Middle English version of the French word, migraine, which could also refer to depression. The Megrim was also known as Hemicrania, being characterised by 'a vehement pain in one half of the Head.[14] Ambroise Paré (1510?-1590) suggested the cause of the disease was 'putride vapours arising to the head from the ventricle, wombe, or other inferior member' or, alternatively (and somewhat ironically) inhaling 'some noisome vapour or smoak, as of Antimony, Quick-silver or the like', in addition to possible contributions from drunkenness, gluttony and the eating of 'vaporous meates'.[15]

Finally, recalling the uses of true amethyst, amothist was commended by Maximinus as being 'very good to staunch blood' when applied directly onto the wound, or worn as an amulet about the neck.[16]

Safaris Stone

The final synthetic stone advertised by Maximinus is the purple-coloured Safaris Stone. Sewn into a silk bag and worn about the neck, the author asserted that, in 20 days, it would help with a variety of diseases whose common denominator was involuntary tremor – palsy, ague, cramp and 'shaking of the Joynts'.

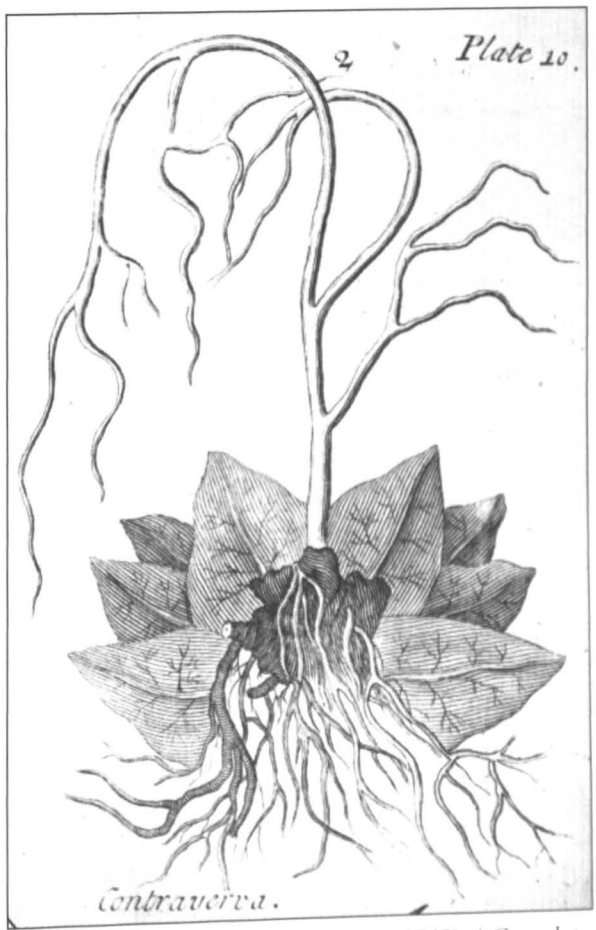

Figure 1. Contrayerva. From Pomet (1748) *A Complete History of Drugs*, Plate 10.

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A blue variety of the same stone, powdered and suspended in Posset Ale and taken first thing in the morning for four consecutive days, was recommended as being

> good for the greene sickness, and procureth urine, and causeth the stone to voyde, and doth expel the wynde in the body.[17]

This list of diseases includes many that were a source of much discomfort, as well as being quite widespread in early modern times; dysuria and renal calculi were common candidates for a whole raft of hopeful cures.[18]

Lapis Contrayerva

John Jacob Berlu (dates unknown, but late 17th century) introduces this as a 'made stone" containing Contrayerva root, pearls, coral, amber, crab's eyes and several other

Table 1. Table to show variation in composition of *lapis contrayerva*.

Ingredient	Manget 1703	Browne (1721)									Hodges 1721	Bradley 1730	Berlu 1738	Anon 1746	Hill 1751	New Dispensatory 1753
		Recipe 1	Recipe 2	Recipe 3	Recipe 4	White	Red	1628 (1)	1628 (2)	1636						
Contrayerva root	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Antimony		×		×		×	×			×	×					
Crab's eyes			×	×		×	×		×			×	×			
Crab's claws	×	×								×	×			×	×	×
Carduus Water						×										
Magistery of Pearl						×										
Pearl	×		×	×				×	×			×	×		×	
Magistery of Coral	white and red			×												
Coral			×			×					red	red	×		red	
Hart's Horn Jelly or calcined		×	×	×		×						×				
Isinglass						×		×								
Cochineal					×		×	×	×		×					×
Bezoar Mineral							×									
Bezoar Animal		×								×						
Bezoar Oriental			×								×					
Lemnian Earth								×								
Snake Root					×			×	×	×	×					×
Kermes Juice								×		×						
Saffron				×					×		×					(English)
Syrup of Betony										×						
Citron										×						
Angelica seeds										×						
Angelica root											×					
Tormentil root											×					
Ambergris	×		×							×	×	×				
White Amber	×		×									×	×			
Lemnian earth			×													
Silesian Earth			×													
Mucilage of Quince Seed				×												
Valerian					×											
Camphor					×											
Bole Armeniac					×											×
Confectio Alkermes					×											
Snake skin jelly	×										×					
Surface gilded	×												×			
Gum Arabic												×				

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ingredients 'which after 'tis gilded over, smelleth strong of the root".[19]

Contrayerva (Fig. 1, p.3), a small plant belonging to one of several species of *Dorstenia*, has scaly, knobbly rhizomes which are also known as Drake Root or *Drakens Radix* on account of its introduction into Europe in around 1581 by Sir Francis Drake (circa 1540-1596).[20] The name means 'against poison' and indigenous tribes of the Amazon use it to treat both snakebite and the poisonous bites of various insects. Various South American peoples are recorded as consuming it as a salad plant, placing strips of it under the soles of their feet during winter time, and feeding goats with it so that they are stimulated to produce bezoar stones.[21] It is used widely in modern day Venezuela, Argentina, Mexico, Trinidad, and especially Brazil where it is often employed against fevers and a wide range of other conditions. When introduced into apothecary's shops in Paris (1602) it was used extensively in plague remedies; Nathaniel Hodges utilised it during the Great Plague of London in 1665.[22]

The composition of *Lapis contrayerva* is the subject of some variation (Table 1, p. 4). The simplest involves mixing five ounces of Contrayerva root with one and a half pounds of the powder of crab's claws (*chelae cancrorum*).[23] In addition to these two basic ingredients, Nathaniel Hodges lists extract of Virginia Snake Root, Angelica, Tormentil, Red Coral, Antimony, Saffron, Oriental Bezoar, Ambergris and Viper skin jelly in his version of the composition.[24] Another recipe incorporates pearls, coral, amber, crab's eyes (*oculi cancrorum*), oriental bezoar, black tips of crab's claws, 'Gelly of Hart's Horn, made with Dragon-water, a little tinctur'd with saffron' ground finely in a mortar, worked into balls and then dried.[25] Joseph Browne (dates unknown, active 1700-1721) gives several recipes for the stone which he says resulted from the popularity of the root in various therapies against plague. He lists a number of ingredients involved in the production of the stone, some of which are omitted entirely from the recipes for which later he provides details: Rock Crystal (quartz), Zedoary, Bistort, Carline Thistle, Butterbur, Elecampane, Mastic, Musk, Scordium and Scorzonera, and the white of an egg.[26] Among the nine recipes he gives are two that give distinctively coloured stones – one white and one red. He recommends the latter in cases of smallpox and purple fever. The English natural history writer, Henry Barham (circa 1660-1726) noted that he often added Arrow-root to his own version of *Lapis contrayerva*.[27]

Like the Goa Stone, *Lapis contrayera* was used extensively as an alexipharmic (antidote); John Quincy (died 1722) variously mixed it with Gascoign's Powder, Mithridatium, Saffron, Confection of Alkermes and Diascordium in a range of alexipharmic medicines during the late 17th and early 18th centuries.[28] Some popular texts recommended its use, as with indigenous peoples, against snakebite.[29]

Joseph Miller's (1722) *Botanicum officinale* indicates that *Lapis contrayerva* was the only means by which Contrayerva root was taken at the time, but within 30 years, in 1751, Sir John Hill (1714-1775) recorded that the standard and recommended means of storage was in powdered form as *Pulvis Contrayerva Compositus*.[30] Shortly afterwards, he had arrived at the opinion that it was 'better to give it alone than in that mixture of crab's claws and other useless ingredients', and that administering it in the form of a tincture was best of all.[31] *Lapis contrayerva* was praised for its various properties, including as a cordial, tonic, alexipharmic, sudorific, stomachic, and stimulant, and it was used in 'all sorts of Malignant Fevers, and pestilential Distempers, resists Poisons and the bites of venomous Creatures', toothache, to 'strengthen the Stomach, dispel Flatulencies and help Digestion', typhoid fever, smallpox, diphtheria, 'gangrenous sore throats., indigestion, colic, weakness of the stomach, as well as being 'good in nervous cases'.[32] It was even used to promote sweating in horses and as part of the treatment for 'contagious distemper amongst Cows' (Anthrax?).[33]

In at least one remarkable instance a specimen of *Lapis contrayerva* has survived in a cabinet of materia medica for over 300 years. The specimen forms part of a teaching collection made by the Veronese chemist Giovanni Francesco (anglicised to John Francis) Vigani (circa 1650-1713), and is currently stored in the Long Room at Queens' College, Cambridge. Vigani was elected to the first ever Chair of Chemistry in 1702, teaching at Queens', St Catharine's and Trinity Colleges in Cambridge until 1708.[34] The specimen of *Lapis contrayerva* has the form of a white, finely granular, flecked, chalk-like stick, measuring around 2 cm in length and broken at one end (Fig. 2).

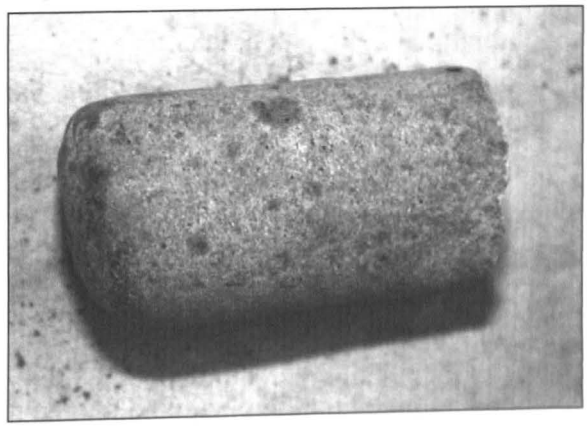

Figure 2. Specimen of *lapis contrayerva* from drawer F 23 of the early eighteenth century materia medica cabinet of John Francis Vigani. By kind permission of the President

Lapis Alexiterius

Asserted by some as identical to *Lapis contrayerva*, *Lapis alexiterius* is nevertheless a different preparation, but with some ingredients in common. Thomas Fuller (1654-1734; Fig. 3), the Cambridge-trained physician who practised in Sevenoaks, Kent, specifies in his *Pharmacopoeia extemporanea* (1722) that it contains amber, red coral, antimony, crab's eyes, crab's claws, all powdered together on a porphyry slab and mixed with ambergris.[35]

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Treacle Stone

Joseph Browne's *Antidotaria* (1721) is the only source traced for this preparation.[36] Used in the treatment of plague, one of its main ingredients was 'Hartman's Diaphoretick' or Flowers of Antimony. This is essentially sublimated antimony trioxide (Sb_2O_3), a chemical subsequently discovered naturally occurring as the mineral Valentinite. To this was added whole powdered viper, crab's eyes, cochineal, mother of pearl, white amber, orange peel, angelica, saffron, kermes berry (the scale insect, *Kermes vermilio*), and roots of Bistort, Tormentil and Scorzonera. *Scorzonera* is a genus belonging to the Asteraceae, latex from the roots of which have proven analgesic properties and which has an extensive pedigree of use in European (especially Turkish), Chinese and Mongolian folk medicine.[37] This list of ingredients was then mixed with Venice Treacle, itself a popular alexipharmic and binding agent, before being worked into a 'Mass' which presumably acted as a source from which to scrape therapeutic powders. The eponymous treacle was believed to act magnetically, drawing poisons out of the body tissues. One of its most celebrated active ingredients was viper flesh; the addition of powdered whole viper in this recipe may have been seen as reinforcing the action of the Theriac by sympathetic magic (*similia similibus curantur*).

Figure 3. Thomas Fuller (1654-1734). Line engraving by G. Vertue after I. Tymewell. Wellcome Library, London.

Table 2. Table to show variation in composition of *lapis mirabilis*.

	Schroeder 1655	Jungken 1697	Solleysel 1717	Salmon 1710
White vitriol	X	X	X	X
Green vitriol	X	X		
Sal nitris	X	X		
Sal petrae	X	X		
Sal ammoniac	X	X		
Sugar	X	X		
Rock alum	X	X	X	X
Camphor	X	X		
Bole Armeniac			X	X
Litharge				X
Litharge of Gold			X	
Litharge of Silver			X	

Lapis mirabilis

Lapis mirabilis, *Lapis mirificus* or the Wonderful Stone (Table 2) enjoyed considerable popularity in the 17th and 18th centuries. It seems to have originated with the

Figure 4. Johann Schroeder (1600-1664). Wikimedia Commons.

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Figure 5. Jacques Labessie de Solleysel (1617-1680). Wikimedia Commons.

German Paracelsian physician, Johann Schroeder (1600-1664; Fig. 4), who is perhaps most famous for isolating Arsenic in 1649 by heating white arsenic (As_4O_6) with charcoal. Schroeder moved around Europe a lot during his medical career, studying at Rostock, Copenhagen, Leiden and Caen; after serving as an army surgeon for Swedish forces in the Thirty Years War, he settled in Frankfurt, serving as physician to the Landgrave Hesse-Darmstadt. It is probably while he was here that he wrote his *Pharmacopoeia Medico-chymica* first published in 1649. His recipe for *Lapis mirabilis* consisted of white vitriol ($ZnSO_4$), green vitriol ($FeSO_4$), sal nitris (probably Na_2CO_3), sal ammoniac (NH_4Cl), fine sugar, alum and camphor, finely powdered together and blended with olive oil to form a honey-like consistency, before being baked slowly into stony structures.[38] It was used in the same way as *Lapis salutis* (see below).

The stone was quickly adopted as a therapeutic agent in farriery. Jacques Labessie de Solleysel (1617-1680; Fig. 5) was self-taught as a horseman and veterinarian and rose to become instructor at the Paris Academy, engaged in training members of the French nobility in the art of horsemanship. His *Le parfait mareschal* was published in 1679 and an English translation produced in 1696. In it, he commends a solution of *Lapis mirabilis* as 'the only Sovereign Remedy' which may 'serve above all others'. His method of preparation differs a little from that of Schroeder, with several ingredients being omitted and Bole armeniac, and either Litharge of Gold or Litharge of Silver (mixtures of lead (II) oxide and lead (IV) oxide, and a by-product of separating silver from lead respectively) being introduced anew. The ingredients were boiled gently in water over an even heat from a smokeless fire such that the water evaporated leaving a hard residue. This stony material was then powdered into water when required and used to irrigate horses' eyes if they suffered from 'Rheums, Blows or Moon-eyes'. When applied either as a wash or as part of a compress directly to wounds or inflammation, especially on the back, *Lapis mirabilis* was judged to be 'good to resist Corruption'.[39] Solleysel's work formed the basis for many subsequent derivative farriery volumes.

William Salmon (1644-1713; Fig. 6) used an identical recipe to that of Solleysel, and he suggested dispersing half an ounce of the powdered Stone in water from a Smithy ('Smith Forge Water'). The liquid could then be applied as a wash over old sores and minor wounds, or as part of a compress to reduce inflammation. As an eyewash or collyrie applied morning and evening, it was credited with the ability to reduce inflammation, heal ocular sores and ulcers, and prevent 'Fluxions of Rheum into the Eyes'.[40]

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Figure 6. William Salmon (1644-1713). Wellcome Library, London.

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Representing pharmacy: The Pharmaceutical Society of Great Britain's first Diploma

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Shortly after its launch in 1841, the Pharmaceutical Society of Great Britain approved its first Diploma, a black and white design intended to convey the profession's character and ethos. In the 19th century tradition it combined text and image. In fact image predominated and text was confined to a central medallion, shaped to hold the certificate and recipient's name. On either side of the medallion were imposing 'imaginary portraits' of two classical authorities on medicine and materia medica. Avicenna on the left, author of the *Canon of Medicine*, in turban, tunic and cloak, pointed with a staff of Asclepius at a wreath of medicinal plants bordering part of the medallion's circumference; and on the right, Galen, the Greek physician, bare-headed in tunic and cloak, held a weighing scale. The medallion and its flanking figures rested on a pedestal, ornamented with a central bas relief of an alchemist at work in his laboratory and decorated in recessed side-panels with chemical and pharmaceutical vessels. A mortar and pestle, supported by the upper edge of the medallion, formed the Diploma's summit.[1]

Origins

It was turf wars between medical practitioners for professional and economic advantage, compounded by the prospect of restrictive government legislation, which pushed chemists and druggists towards association. Pharmacy was to some extent the victim of its own success. In the 18th century, urbanisation and consumer revolution brought rapid growth, but a century later the marketplace in medical services had become too crowded for comfort. Less organised than the longer-established apothecaries, physicians and surgeons, and less qualified and more closely connected with trade, the chemists and druggists faced an uncertain future. The leading metropolitan and provincial founders of the Pharmaceutical Society believed that unity and professional education were the only guarantors of survival and long-term security,[2] and the Diploma was a small but not insignificant part of the strategy by which they intended to achieve their aims.

Cultural objects were important in the creation of professional identities, communicating and strengthening confidence and shared values. Medical men were prolific commissioners of portraits and works of sculpture for display in the private and public spaces of library and consulting room, college and hospital. Professional bodies, their numbers on the increase in Georgian and Victorian Britain, issued certificates and medals to mark and promote practitioner excellence, and more broadly to foster a reputation for competence and gentility. These artefacts were often illustrated and they frequently referenced noteworthy people and things from the past likely to enhance contemporary standing. The Diploma followed suit, presenting pharmacy as an honorable, historically-rooted calling, integral to the practice of modern scientific medicine.

In an early issue of the *Pharmaceutical Journal*, its editor, Jacob Bell, traced the origins of the Diploma back to a meeting of provincial chemists called to discuss the future of the profession: someone had suggested that members of the Society receive a document, signed by President and Council, that might distinguish them from the incompetent and unqualified in the eyes of the public.[3] Another story, or perhaps a different version of the same story, credited the editor himself with this idea.[4] Whatever the precise manner and sequence of the project's genesis, Jacob Bell was instrumental in taking it forward. By May 1841 a Diploma Committee had been set up under his leadership and a few months later produced for inspection a draft design along with style samples to illustrate the type of engraving envisaged.[5] Society members, busy metropolitan pharmacists for the most part, chose to squeeze the viewing of these art works in between their deliberations on superior quality filter paper and specimens of 'iodine of potassium, gum

Figure 1. Jacob Bell, pharmacist, art lover and chair of the Diploma Committee. Photograph by Barrauds, London. Museum of the Royal Pharmaceutical Society

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mastic, dragon's blood etc.'[6] At the later stages of the Diploma's realisation, a proper sense of occasion was observed: the first certificate to come off the press in the spring of 1842 was symbolically presented to the Society's first President, William Allen. Certificates were impressively large in size (24 x 19.5 inches; 61 x 49.5 cm) and printed on heavy, fine quality paper; the Diploma was published in the first bound volume of the *Pharmaceutical Journal*, as its frontispiece.[7]

Designers: Jacob Bell, HP Briggs

Jacob Bell was the son of a respected and successful Quaker pharmacist, a keen advocate of science and professionalisation, a member of the recently formed Chemical Society and a skillful organiser whose judgment the leaders of the Pharmaceutical Society were inclined to trust. In addition, they knew him to be a man with a 'taste for the fine arts'.[8] In his teens he had shown a gift for drawing, and his father, despite religious beliefs that committed adherents to disapproval of what they saw as worldly and frivolous pursuits, arranged private lessons and enrolled him in classes at a well-known Bloomsbury art school. All his adult life, Jacob Bell delighted in creating caricatures and satirical drawings of everyday events for the private amusement of himself and his friends, but he recognised that painting was not his metier, and limited public practice to expanding his art collection and offering business advice to the artists among his acquaintances. Friendships formed at the Bloomsbury school with fellow pupils, Edwin Landseer and William Frith, who were both to become popular and influential Victorian painters, gained him extensive contacts in the art world, and cemented his renown among pharmaceutical colleagues for art appreciation and knowledge.

Authorised to produce a diploma design, Jacob Bell secured Henry Perronett Briggs, his former private tutor, for the job.[9] Social networks were important, as the historian Ludmilla Jordanava has shown, in determining the context in which the medical profession created its cultural artefacts,[10] and the partnership between these two men had direct and specific impact on the style and content of their product. HP Briggs, elected Royal Academician in 1832, was a respected though never front-ranking artist, well-known in his life-time for historical paintings and portraiture. His paintings on early modern and Shakespearean themes possessed detail, drama and sentiment in the Victorian manner,

Figure 2. Draft of the Society's Diploma. Miniature Etching,. Size of the original 30 by 19½ inches.' Wellcome Library, London

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while his portraits, mostly executed during the 1830s and early 1840s[11] (including one of Thomas Wheeler, Botanical Demonstrator and Master to the Society of Apothecaries) showed greater economy and restraint. The Diploma, an uncluttered design that gave pride of place to 'imaginary portraits', displayed the artist's talents at their most effective.

Diploma Design

The Diploma design drew on both heraldic and classical traditions. The right to bear arms, initially limited to royal and aristocratic houses, was extended in the early 17th century to public bodies, by which time the standard heraldic components – shield/escutcheon, crest, motto/scroll and supporters – had become well established. The apothecaries were granted arms in 1617, one of the early beneficiaries of the more inclusive policy, and by the 19th century coats of arms had become a familiar component of the everyday visual environment and an influence on other forms of public art. The Diploma with its two flanking figures, its central, shield-shaped medallion and mortar and pestle in crest position was a case in point. In other respects the design took visual inspiration from the fine arts. Its architectural features, wreath and medallion were examples of the neo-classical motifs frequently used in public portraiture and sculpture at the time. Creators of works on medical themes sought accessories that specifically evoked the ancient art of physic and looked to the mythology of Greece, Rome and other ancient cultures for heroic imagery. In 1822, the College of Surgeons made Machaon and Podalirius, the sons of Asclepius, the supporters in their coat of arms; the Medical Society of London employed the Egyptian goddess, Isis, as its symbol; and the Society of Apothecaries continued to illustrate its professional material with the scene of Apollo conquering the dragon of disease from the shield of its 17th century coat of arms.[12] The choice of Galen and Avicenna, – the key scholar/physicians of the Ancient and Medieval worlds – and their placement amidst a densely symbolic arrangement of medical accessories followed this tradition of historical referencing.

Orientalism

The Diploma design gives Avicenna precedence over Galen. He holds the staff of Asclepius and points to the wreath of medicinal plants, and his image is echoed in the turbaned alchymist on the pedestal's bas relief. Avicenna was less well known to the Victorian medical public than Galen, but his writings were still consulted for prescriptions and technical know-how at the beginning of the 19th century. By the 1840s, pharmaceutical and chemical practitioners were finding new aspects of Arabic scholarship to esteem. Jacob Bell gave respectful mention to Avicenna's scientific achievements in his accounts of the history of pharmacy. Jonathan Pereira, the eminent pharmacologist who later in the decade became Jacob Bell's co-editor on the *Pharmaceutical Journal,* recognised the contributions of physicians across the Muslim world between the 8th and 12th centuries to the development of modern chemistry as well as medicine. John Forbes Royle, a physician who had worked for the East India Company before taking up an academic position at Kings College, London, also made the link between ancient pharmacy and the origins of the chemical sciences. The prominent pharmacist and chemist, Thomas Morson, in a lecture to a pharmaceutical meeting in June 1841, described the 'Arabians' as 'perhaps the most learned' of the ancients (though he took issue with their polypharmacy), and spoke glowingly of the 'glorious' age of Alchemy, arguing that in their search for gold and long life the alchemists had built the foundation of present-day chemical knowledge.[13] The inauguration of the Chemical Society in 1841, the same year as the Pharmaceutical Society, was illustrative of the fresh interest in the discipline that warranted new perspectives on Arabic medicine and its alchemic experimentation.

The decision of Jacob Bell and HP Briggs to feature Avicenna in the Diploma should be seen in the context of a broad reappraisal of the Orient, shaped in part by the upswing in international trade and travel at the end of the Napoleonic wars and by growing awareness of Empire and lands to the East among all sections of the British population, artists included. One of the painters to show interest in Oriental themes was John Frederick Lewis, a friend of Edwin Landseer, who made the first of several visits to the Near East in 1837.[14] It seems likely that both Jacob Bell, living a few streets away from the Lewis household and moving in the same circles as the artist, and HP Briggs, a fellow Royal Academician, would have

Figure 3. Portrait of Avicenna.from a 16th century printed book. Wellcome Library, London

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been aware at the very least of this new direction of his work. HP Briggs had himself painted a fine portrait of the Bengali reformer, Rajah Rammohun Roy, who visited England in the early 1830s as ambassador of the Mughal Emperor Akbar II.[15] The Mughal dynasty once ruled from the Central Asian city of Samarkand in Transoxania, not far from Avicenna's home town of Bukhara, and the Arabic physician in the Diploma evidently draws on the artist's first-hand knowledge of Persian dress.[16]

If the Diploma's choice of the two medical authorities reflected the well-established and newly-minted cultural vogues for neo-classicism and Orientalism, it was nevertheless bold and unusual. Representations of Avicenna and Galen, along with other scholars of the Graeco-Roman and Arabic schools, had appeared relatively frequently in Renaissance manuscripts and published books, but there is no trace of them in British medical artefacts in the first half of the 19th century, nor in the intervening period either.

Materia medica

The treatment of the wreath was also far from typical. Garlands of various types were commonplace in classical design and true to this form the medicinal plants that ran along the circumference of the medallion were drawn close together to give the effect of a continuous border. In other ways the wreath was a distinctly contemporary riff on the classical design. Instead of a decorative pattern of repetitive foliage, the artist created faithful facsimiles of the natural world, suggesting a series of specimens. In the 1840s, botany was well established both as successful scientific discipline and popular leisure pursuit. It was a crucial component of the medical curriculum and of the horticultural aspirations of the middle and upper classes. Hefty books on vegetable materia medica and expensively produced botanical journals were published in brisk succession for these expanding markets.[17]

According to Jacob Bell, the wreath represented the connection between *'Botany and Materia medica'*, and the Diploma made the link manifest through its choice of artistic style. The attention to detail, pre-figuring the hyperrealism of the Pre-Raphaelites, would have allowed experienced medical and pharmaceutical viewers to identify the individual components of the wreath and read the message they embodied. The Diploma illustrated a materia medica that had stood the test of time. Of the wreath's key plants, the only recent additions were Jalap and Digitalis, introduced in the 17th and 18th century respectively. Arabic medicine knew Acacia, Hyoscyamus, Papaver, Pinus, Mandragora,[18] Rheum, Rosa, Scammonium, Camphor, Senna and Taraxacum, and all excepting the last three in this list had a history that went back to the Greeks. Not only had these remedies been in use for centuries, they still numbered among the most important and effective treatments in contemporary medicine.[19] Like the medical authorities, the wreath conveyed a story of pharmacy's historical lineage and contemporary relevance. Above all, the portraits and materia medica evoked the quest for scientific medicine and implied a central role for pharmacy in the march of progress.

Interpretation

Between them HP Briggs and Jacob Bell produced a handsome design that was a clever combination of convention and modernity, both in form and content. It was confidently innovative in style, at the same time paying tribute to the traditional iconography of public art. It presented pharmacists as heirs of the ancients – scientific, educated, and responsible – and consequently worthy of a place in the medical community of the present day. Were it not for a short article, 'The Description of the Diploma of the Pharmaceutical Society,' published in the *Pharmaceutical Journal* at the end of 1841, the success of Jacob Bell and the Diploma Committee in fulfilling their brief would have appeared complete.

Although the Diploma moved from first proposal to finished product with speed, its passage was evidently not without incident. Members asked questions that Jacob Bell felt he should answer and perhaps also raised

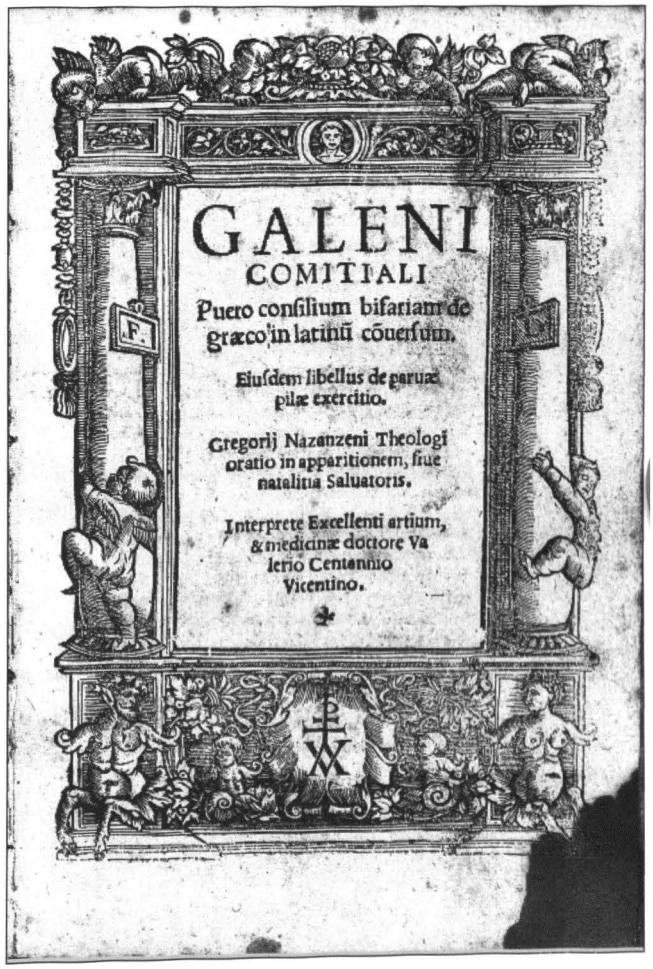

Figure 4. Frontispiece. Galen VC, St Gregorius Nazianzennus. *Galeni Comitiali puero consilium bifariam de graeco in latinum conversum: Eiusdem libellus De paruae pilae exercitio.* Venice: Pintius,1533. Wellcome Library, London

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criticisms that he was anxious to deflect. Victorian institutions did not often hold open discussions about public art works or leave records of their closed deliberations and the 'Description' offers an interpretation of the Diploma that is all the more interesting because its author was attempting to establish points of contact between different ways of seeing.[20]

Some of the information in the Description is relatively straightforward. The author names the Diploma's medical figures and medicinal plants and explains their inclusion. While the turbaned supporter was clearly Oriental, the other European, more precise identification was hampered by the lack of fixed cultural conventions on the defining features of medical authorities from the past; there were no means of distinguishing Galen from Dioscorides, or Avicenna from other Arabic physicians, simply by looking. Renaissance manuscripts and books sometimes resolved this problem by printing names beneath portraits and the Description served the same purpose. Similarly, since nineteenth century chemists and druggists, who dealt primarily with raw drugs, would not necessarily have recognised their fresh aerial parts, the list of the Diploma's medicinal plants, presented in an accessible format – using the nomenclature of commerce and pharmacy rather than botany[21] – permitted more viewers to appreciate the wreath intellectually as well as aesthetically.

Other information in the article evidently seeks to correct negative impressions, counter objections or allay anxieties, in particular those that might have arisen in response to the apparent references to alchemy in the decoration of the pedestal. Until the 17th and early 18th century, medical men considered alchemy a serious tool in the search for knowledge, but with the spread of Enlightenment ideas it gained the reputation of a pseudo-science and Victorians, associating it with magic and occult practices, viewed it with deep suspicion. Jacob Bell and HP Briggs may not have given thought to the impression that their design might make on pharmacists, a pragmatic and empirical body of men, unfamiliar with the latest revisionist assessments of alchemy or the new artistic interest in the East, and more used to the direct and unambiguous communications of advertisement than the allegory and symbolism of public art.

The 'Description' sought in a discreet way to reassure colleagues that the Diploma met criteria for scientific and professional artefacts, downplaying alchemy while at the same time insisting that allusions to it were scientifically respectable. The article described the four motifs of silver, antimony, air and water etched at the corners of the Diploma's central pedestal as 'symbols of the ancients' without mention of any alchemic connection. It recognised the figure in the bas relief as an alchemist but qualified the label in a number of ways. Firstly the use of the archaic spelling, 'alchymist' linked pharmacy with ancient rather than modern alchemy; secondly, the alchymist's place of work – he is 'working in his laboratory' – and his instruments – referred to as 'apparatus' and held to be symbolic of '*Chemistry*' – linked ancient alchemy with scientific modernity. Finally, far from possessing the taint of ignorance or quackery, the alchymist is said to represent *'philosophical* (ie scientific) *research*'.[22]

At a more mundane level, the article claimed that the weighing scales stood for 'Prescriptions accurately prepared', an attempt perhaps to suggest that classical symbols need not be taken literally and might relate to the present-day activities of modern chemists and druggists. In a flight of fantasy, the article went as far as to suggest that one of the four motifs, 'water' or 'Aqua regis', might also be interpreted as a reference to Queen Victoria.[23] Jacob Bell was known for a love of mischievous pranks but this proposition was more likely to have been an earnest attempt to find common ground with his colleagues than a joke at their expense. The same gap in expectations about visual representation is evident over the treatment of the chemists' and druggists' commercial activities. According to the Description, the mortar and pestle representing *'Pharmacy'* was to be understood as a pun on the word 'pound', connecting the action of the pharmacist preparing his medicines to the profit accruing from them.[24] Contemporaries conversant with the visual codes of medical artefacts would have noticed other allusions, less convoluted and more integral to the overall Diploma design. By the 19th century only a tiny minority of medical men possessed private financial means and creators of medical artefacts took as given that their subjects were working professionals. Artists situated medical practitioners in scientific, even heroic contexts, taking care at the same time to acknowledge their remunerative work through accessories. The designers of the Diploma adopted this approach when they included weighing scales, medical staff, medicinal plants and chemical vessels, in addition to mortar and pestle. They had no need of a pun as well. Jacob Bell apparently preferred to put forward a retrospective rationale, which however strained was safer than a lecture on modern medical symbolism that risked patronising and offending colleagues.

Contemporaries acknowledged Jacob Bell's social skills, charm and powers of persuasion. His article – no doubt supplemented by interventions at Council meetings and private conversations – effectively dispelled any reservations that Society members might have had about the design's fitness for purpose. In any event, there is no further trace of criticism of the Diploma on record, all the evidence pointing in the other direction, towards its rapid acceptance by the profession. Oppositional groupings within the Pharmaceutical Society, highly critical of Jacob Bell for his alleged arrogance and incompetence[25] and likely to have made the most of any disagreements on a project for which he was responsible, did not mention the Diploma in their list of grievances. Local chemists were eager to incorporate the design in their business material, even too eager on occasion, according to the *Pharmaceutical Journal*.[26] And in 1844, the Society used the design as template for

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its successful application for a coat of arms. The Diploma in other words established itself rapidly as one of the Society's main visual markers, respected and valued both by members and the public, and it remained in use for well over a hundred years, framed and visible on pharmacy walls, signifying membership and qualification, just as the anonymous chemist in 1840 had proposed.

Conclusion

The diploma design was a success on many fronts: it was practical, cost-effective, aesthetically pleasing, culturally appropriate, and professionally and conceptually acceptable. A single copy, over the career of its recipient, might be seen by hundreds of colleagues and thousands of customers. Undeniably elegant, the design met accepted artistic criteria for a document of its genre, and provided a succinct visual statement of the purpose and principles of the pharmaceutical profession, accessible on several levels. Over subsequent decades, knowledge of Latin and with it the history of pre-modern medicine continued to decline and Galen was rarely mentioned in medical textbooks, beyond the occasional reference to the medicinal preparations that bore his name or a footnote on the burning of his books. Interest in chemistry's early history quickly peaked and Avicenna was erased even more thoroughly as a cultural reference point. The association between medicinal plants and modern materia medica grew more tenuous. But the basic visual grammar that underpinned the design remained intact, and the Pharmaceutical Society had no reason to consider a revision. While the public might miss specific allusions, they understood the Diploma's promise of competence and trustworthiness, and medical men recognised its declaration of professionalism and commitment to science.

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4. Bell J and Redwood T. *An Historical Sketch of the Progress of Pharmacy in Great Britain*. London: Pharmaceutical Society of Great Britain, 1880: 148.
5. Henry Chawner Shenton, a leading line engraver of the period, prepared the Diploma plate for the press. The previous year he had completed 'The Tired Huntsmen', after a painting by Charles Landseer, a friend of Jacob Bell's and it was this connection that most likely recommended him for the Diploma commission.
6. Bell, Reference 1: 264.
7. For William Allen's life and times, see Chapman-Huston D & Cripps EC. *Through a city archway: the story of Allen and Hanburys*. London: J Murray, 1954: 47-131. The Diploma engraving formed the frontispiece to the first volume of the *Pharmaceutical Journal*, published in 1842, containing issues 1-12, July 1841 to July 1842.
8. Bell and Redwood, Reference 2: 148.
9. Juanita Burnby, in her entry on Jacob Bell in the *Dictionary of National Biography*, states that HP Briggs was a distant relation of Jacob Bell, but provides no source. Juanita Burnby. 'Bell, Jacob (1810–1859)': *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [http://www.oxforddnb.com/view/article/2006, accessed 13 March 2014]
I have been unable to find corroborating evidence of their kinship. Theophilus Redwood who had served an apprenticeship at the Bell family pharmacy refers to HP Briggs merely as a 'friend'. Bell and Redwood, Reference 2: 148.
10. Jordanova L. *Defining features. Scientific and Medical Portraits 1660-2000.* London: Reaktion, 2000.
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12. Blandy JP and Lumley JSP, eds. *The Royal College of Surgeons of England. 200 years of history at the millennium*. London: Royal College of Surgeons and Blackwell Science, 2000: 10, 21; Hunting P. *The History of the Medical Society of London 1773-2003.* London: Medical Society of London, 2003: 168; Hunting, Reference 11: 141, 199.
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15. *The Exhibition of the Royal Academy, London.* Clowes, 1832: 6.
16. Avicenna was a native Farsi speaker, but wrote his medical and philosophical works almost all in Arabic, which was the lingua franca of scholarship in the Muslim world at that time.
17. Blunt W. *The Art of Botanical Illustration*, London: Collins, 1950: 209-228.
18. By the 19th century Belladonna rather than Mandragora was employed in learned medicine and it is Belladonna rather than Mandragora that is pictured in the wreath. Both plants are from the Solanaceae family and have similar constituents and use. Both Graeco-Roman and Arabic medicine used Mandragora, the former may have used Belladonna also.
19. Jalap was a new world remedy, sourced from Mexico. Though foxglove (digitalis) is native throughout Europe, it was not part of Greek (or Arabic) materia medica and featured only occasionally and obscurely in early British herbals; digitalis became established in orthodox medicine at the end of the 18th century, through the work of William Withering. The camphor used by Avicenna and other Arabic physicians was derived from Borneo camphor, *Dryobalanops camphora*; by the 19th century the camphor in commerce came from the East Asian *Laurus camphora* (*Cinnamonum camphora*), a much cheaper source, and it is this species that is illustrated in the wreath.
20. There are no extant letters, notes, drafts, if such ever existed, relating to the partnership between HP Briggs and Jacob Bell or to the activities of the Pharmaceutical Society's Diploma Committee.
21. The 'Description' refers to items in everyday domestic use by their English common names – rhubarb, roses, senna – and to those used in orthodox medicine by the first part of their Latin binomial name – digitalis, belladonna, hyosyamus. The full Latin binomial is used only in relation to 'laurus camphora', the contemporary source of camphor, to distinguish it from the Borneo camphor used in Arabic medicine [see Ref. 19].
22. Like Thomas Morson, Jacob Bell expressed a high opinion of classical alchemy. He described alchemists' 'most persevering and laborious researches' and their contributions to development of metal and chemical remedies, see Bell J. *A concise historical sketch of the progress of pharmacy in Great Britain*, London: John Churchill, 1843: 9-12.
23. Bell, Reference 1: 264-5. Jacob Bell's choice of words suggested that this was a legitimate interpretation, though not necessarily the one intended by the design creators. It does not seem likely that Jacob Bell and HP Briggs would hide a patriotic reference in such a nondescript and easily overlooked feature of their design. Nor does nitro-hydrochloric acid (aqua regis), a corrosive, fuming substance, leap to mind as a suitable metaphor for 19th century monarchy.
24. Bell, Reference 1: 264.
25. Cloughly CP, Burnby JGL and Earles MP, eds. *My Dear Mr Bell: Letters from Dr Jonathan Pereira to Mr Jacob Bell, London, 1844 to 1853.* Madison: American Institute of the History of Pharmacy/ British Society for the History of Pharmacy, 1987: 91-95. See also, *Annals of Pharmacy and Practical Chemistry*1852; 1: 1.
26. The *Pharmaceutical Journal* cautioned against the widespread practice of using the diploma design to illustrate advertisements for non-pharmaceutical goods. On the Professional Character of the Pharmaceutical Chemist. *Pharmaceutical Journal* 1842: 5.

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Drug shortages in World War I: How German pharmacy survived the years of crisis

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In Germany, political crisis and the outbreak of World War I a hundred years ago led to severe supply shortfalls in almost every economic area, as goods formerly imported from the enemy or overseas were no longer available. This was the case in the pharmaceutical industry as well as in every single pharmacy. So it seems interesting to explore how industry and pharmacies coped with the situation and what efforts were made to guarantee the best possible way of drug supply on different levels. Several strategies are obvious and can actually be identified. Those include all measurements of rationing as well as the search for raw materials or products able to substitute for missing goods as far as possible. In 1916, when shortcomings became more and more visible in every single pharmacy, the famous Swiss pharmacist and botanist Alexander Tschirch made several suggestions concerning, as he called it, 'war chemistry'[1] and 'war botany'[2]. It will be of further historical interest to know if, and how far, the creativity forced by wartime circumstances led to sustainable developments or inventions that survived the war and remained of value in times of peace and free trade.

Alkaloid production

In Germany of the early 20th century, most medicines for patients were still individually prepared in local pharmacies, although industrial production of drug preparations had already begun. Tablets and even ampoules had been commercially available since the 1880s and replaced more and more traditional and handmade preparations, while solutions and semi-solid preparations remained a domain of the pharmacist. So during World War I, German pharmacists had to rely on a sufficient supply of industrial products on one hand and of raw materials for their home-made preparations on the other. On a higher level, industry suffered from short supply of raw materials imported from abroad, for example solvents or medicinal plants of foreign origin. Alkaloids, for example were often extracted from rather exotic plants, at least from a central European perspective. The Merck Company, the main manufacturer of alkaloid pure substances and preparations, faced severe problems. The situation became even worse as the British Tabloid preparations (Burroughs Wellcome), with their relatively big market share in Germany, were no longer available so that the request for domestic products additionally increased. It is interesting to note that the discoverer of morphine, Friedrich Wilhelm Sertürner, had already worried about supply shortfalls due to the dependence on foreign raw materials.[3] In fact, this scenario came true for the Merck company in wartime, despite having had extended stockpiles.[4] So in October 1916, atropine production stopped, as *Hyoscyamus* species Merck usually imported from Africa were no longer available. At the same time, production of cocaine, which was still used as a local anaesthetic, also ceased. It also turned out that the switch from ether to the more effective benzene as the main extraction medium in the 1890s was a disadvantage, as benzene was hardly available in wartime.

As chemical synthesis had already made some progress in the early 20th century, it was obvious to look for synthetic routes based on domestic materials to substitute natural products. Attempts were made but with variable success. There are some cases where synthetic alternatives had already been available prior to the war and there are others where the deficit promoted chemical research that became effective decades later. In his book *The war of invention,* Guy Hartcup[5] found different examples where necessities of war catalysed developments that were also highly useful in times of peace. Among many other examples he focuses on the development of synthetic local anaesthetics like procaine, which had been synthesised by Alfred Einhorn in 1898 and regularly used since 1904. This was originally a German development which could easily be used instead of cocaine which had a great deal of other disadvantages. According to Hartcup, synthetic local anaesthetics hitherto imported from Germany, were soon in short supply in the British Forces, which caused hectic attempts to develop synthetic procedures in British laboratories as well.

Camphor substitutes

A compound widely used in industry and medicine was camphor, a natural product isolated from the East-Asian tree *Cinnamomum camphora* by distillation. In 1915, 90% of the world supply, amounting to 4000 tons, came

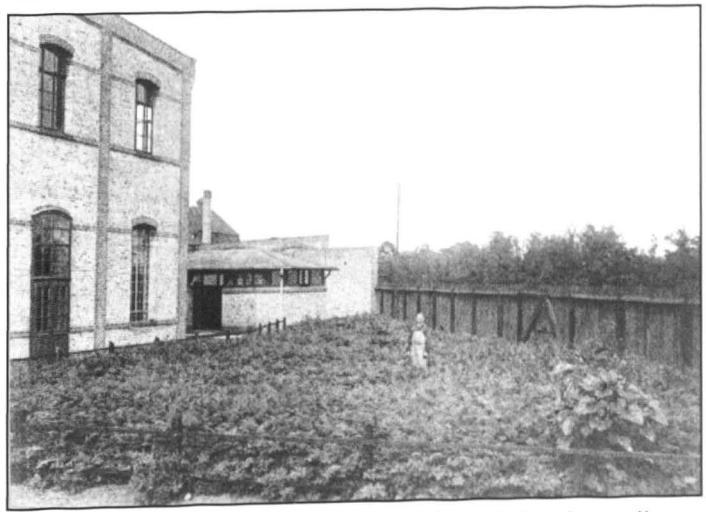

Figure. Hemlock (*Conium maculatum*) plantation for coniine production at Merck, Darmstadt, 1912.
With permission from Merck Corporate History.

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drugs' as substitutes for imported medicinal plants and only saw major problems in substituting rhubarb, *Strychnos* seeds and ipecacuanha root.[2] All other herbs could be replaced by plants containing chemically or pharmacologically similar compounds. He strongly recommended the systematic organisation of the collection of herbs, wherever possible guided by a pharmacist. From 1917 onwards, this was done by the so-called 'Hortus-Gesellschaft'. For example, the society edited 32 leaflets with information for collectors and a description of the most important medicinal plants. Collectors were primarily disabled war veterans, housewives, railwaymen and school children.[14] This situation was paralleled in World War II, when collecting medicinal plants was regarded as a nationwide and highly relevant task for those not serving in the army. Pharmacists were also involved as experts and guides, but most collectors were school children between 10 and 14 years of age.[15] Domestic vegetable materials were also used to replace materials needed in daily pharmaceutical practice, for example wound dressing materials or even cork stoppers. Beech tree fungi (*Fomes fomentarius*; tinder fungus) served both purposes, their fibres could be woven into some kind of gauze or even compacted into stopper-like plugs for bottles.[16]

Glycerin and ointments

Among the most severe shortcomings in wartime industry and daily life was the lack of fat and everything derived therefrom. Fat was primarily used for food purposes and was therefore no longer available for industrial production. Again, this concerned big business as well as the local pharmacy. The absence of fat caused severe shortages of products like soap or glycerin, the pharmacist missed ointment and suppository bases. Cacao butter as well as petroleum jelly came from abroad and fat in general was rare and allocated. So from 1916, the use of pork fat or lard for the preparation of ointments was forbidden.[17] Substitutes were often of miserable quality and sometimes caused more harm than the disease to be treated. The famous dermatologist Paul Gerson Unna (1850-1929) for example complained about ointments made of raw and dirty wool fat as a reason for keratoderma and allergic skin reactions.[18]

In particular, the demand for glycerin, usually produced by hydrolytic cleavage of fat, became extremely high, not caused by medicinal needs but by the extended use of dynamite, nitroglycerine, in times of war. It has also been used as an anti-freezing agent and a lubricant in machinery and weaponry. The explosive material was tremendously important not only in the war, but also for industrialisation in general, to a great degree depending on the availability of metals. So it has been stated, that

> It is interesting to contemplate the effect of explosives on the development of civilisation in some parts of the world. Before the development of mining with high explosives, the principal economic desire of the human race, after food and survival, was the search for surface metals.[19]

In the 19th century hydrolysis of fats was the primary process for glycerin production, and was used for the manufacture of soap and stearin candles. As fat became scarce, people remembered a discovery made by Louis Pasteur in 1858. He had observed that glycerin developed in small amounts as a by-product of alcoholic fermentation. Thus, research concentrated on methods of increasing the yield of glycerin in fermentation processes. In Germany, two working groups succeeded. Firstly, Wilhelm Connstein and Karl Lüdecke, and secondly, biochemist Carl Neuberg.[20] He tried to explore the biochemistry of the fermentation process by stopping the reaction at different stages. Raising the pH of the fermentation broth by addition of a certain amount of sodium sulfite increased glycerin yields up to 20%. A patent was granted for Connstein and Lüdecke in 1915 but was exclusively utilised by the German armed forces.[21] They founded the so-called Protol company, referring to the chemical nature of glycerin, also known as propanetriol. The main purpose of the company was the production of 800 to 1000 tons of glycerin for nitroglycerin production. It has been stated that every German missed 6 kg of sugar a year which were needed for glycerin production; the availability of sugar decreased from 25 to 17 kg a year per person in 1917, simply reflecting the glycerin demand.[22]

In order to save glycerin, substitutes were proposed for different, including pharmaceutical, purposes. They included solutions of sodium and potassium lactate, marketed under the trade names perglycerin or Perkaglycerin. These had also been developed by Carl Neuberg who had observed during his fermentation studies

Table: Rules for prescribing in wartime (from 'Kriegsverordnungsregeln', Germany 1916)[17]

Prescribe in small quantities only
Do not prescribe cosmetic preparations like soap and hair tonics
Do not prescribe oils also useful for alimentary purposes like olive oil, groundnut oil etc.
Do not prescribe lard, completely forbidden for external use in ointments (also to be preferentially used as food)
Prescribe only small quantities of alcohol, and only if necessary (alcohol was often being produced from potatoes)
Be restrictive with bandaging materials, preferentially to be used for military purposes
Do not prescribe
Nafalan (no longer available from Russia)
Glycerine (to be preferably used for military purposes)
Guttapercha (no longer available)
Substitute the following products (by)
Petroleum jelly (Eucerin, wool fat)
Starch (talc)
Boric acid (hydrogen peroxide)
Potassium chloride (alum, hydrogen peroxide, soda)
Chamomile flowers (hay blossoms)
Rubber medicinal products (glass syringes, etc.)

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from the island of Taiwan and 10% from Japan and China.[6] In wartime, it was widely used as a cardiovascular stimulant for wounded soldiers. Applied topically, it increases blood circulation and acts as a mild local anaesthetic. It was also used as a moth repellent and against mites in beekeeping. It was a common ingredient of the pharmaceutical equipment of the armed forces. In technology, the terpene was highly important as a plasticizer and raw material for celluloid production. Camphor synthesis was developed in the late 19th century and became technologically relevant from 1903 onwards.[7] In 1905, 10% of the camphor used was already of synthetic origin. In Germany, the Schering Company was one of the biggest producers of synthetic camphor. In the beginning this was not used for medicinal purposes as there were severe doubts about quality. First of all synthesis only led to the racemic product, while only one stereoisomer was used pharmaceutically. Then, by-products derived from the synthetic pathway were suspected. Furthermore, the German Phamacopoeia required natural camphor, so the synthetic one was basically not allowed for use in therapy. From 1915 onwards, the use of the synthetic derivative was regularly used at least in external preparations. During the following years, synthetic camphor also became unavailable as pinene usually derived from French and American turpentine oil was needed as starting material. Thus, rationing procedures were implemented[8] and substitution products were developed which again were used primarily in external preparations. Those included fenchone or a mixture of eucalyptol and methyl salicylate, marketed under the trade mark Kampferol by the German wholesaler Hageda.[9]

Cignolin (Dithranol)

While in the case of procaine and camphor synthetic procedures had already been available before 1914, wartime misery was the starting point for extended pharmaceutical chemistry research that turned out successfully sooner or later. One example is the development of the antipsoriatic agent Cignolin, also called dithranol or anthralin, originally synthesized as a wartime substitute for chrysarobin, a first-line agent against psoriasis since its introduction in the 1850s. Chrysarobin is a main constituent of Araroba powder derived from the Brazilian tree *Andira araroba*. It is also called Bahia or Goa powder, names which refer to the tree's countries of origin. In WWI it was no longer available as it had to be imported from South America. According to a description from around 1900,

> chrysarobin is a more or less impure neutral principle extracted from Goa powder by boiling in benzene. It is losing ground as a remedy on account of the occasional recurrence in a more severe form of the maladies that it appears to cure, and also on account of its irritating and staining qualities. *Erythema*, with swelling and cuticular desquamation, with reddening of the conjunctiva, are the effects of its application to the face or scalp. Intensely painful inflammation may succeed, lasting several weeks.[10]

Thus, it was by far not an ideal therapeutic compound, and a substitute was urgently needed. The short supply as well as the therapeutic disadvantages prompted the German dermatologist Eugen Galewski (1864-1935) to search an alternative in close cooperation with the Bayer company. Bayer and Galewski received the patent for the newly synthesised but chemically related derivative dithranol in December 1916.[11] The compound was more effective than the treatment options before and had fewer and milder side effects. So skin affections of the head and face became treatable and the staining effect was much weaker.

Lobeline

Besides camphor, preparations of *Lobelia inflata* were regularly used as a respiratory stimulant and in the treatment of asthma. The plant which was also called Indian tobacco grows in the Eastern part of North America in the Great Lakes region. It has traditionally been used as a tincture although the Merck Company marketed small amounts of an extract from 1883 until 1927. For a long time the nature of the active ingredient remained unclear until the German chemist Heinrich Wieland (1877-1957) extracted and crystallised the alkaloid lobeline. Elucidation of its chemical structure lasted several years as no adequate supply of plant material was available during wartime. In 1921 the German company Boehringer started to offer a preparation containing the pure alkaloid which, however, had still to be isolated from the plant. This was much better tolerated than the whole extract containing by-products which regularly caused nausea and vomiting in patients. Wieland and two of his PhD students investigated possibilities of a lobeline total synthesis and succeeded in 1927.[12] However, a technically suitable synthesis procedure was not developed until 1937 when Boehringer started to market synthetic lobeline just before World War II. The product, which was still largely used as a medicine in the German army soon became the company's blockbuster and was marketed until the year 1980, being recommended as an agent for smoking cessation in the last decades.[13]

Collecting domestic plants

Camphor tree, Araroba powder and Lobelia herb were by far not the only plant materials no longer available after the War had begun. In fact, Germany was soon cut off from every kind of foreign supply of medicinal plants. Moreover, in some kind of enthusiasm for newly developed synthetic drugs and medicinal progress in general, collection and domestic cultivation of medicinal plants had been neglected. Circumstances of the war made it necessary to concentrate again on domestic medicinal plants. German pharmacists received advice by the German Alexander Tschirch, a professor of botany living and working in Switzerland, who created the term 'war botany'. Tschirch regretted that the German pharmaceutical industry had rejected his earlier suggestion to obtain turpentine and pinene from domestic conifers and their needles as raw material for camphor synthesis. He suggested a variety of, as he called them, 'parallel

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that lactates could imitate some of the physical properties of glycerin, primarily in terms of viscosity.[23] It was also useful as a lubricant in greasing mechanical weapons and was cheaper than the original glycerin. It was also useful for pharmaceutical purposes and as an ingredient of cosmetic preparations. It had some antiseptic properties, but was not useful for combination with soap, tanning agents and coal tar products. Another disadvantage was that it was also not available in unlimited quantities, as the production of lactic acid was also limited in wartime.

One of the most prominent glycerin substitutes was ethylene glycol, whose physical properties were quite similar to those of the original. It was easily available from ethylene and was useful as a pharmaceutical excipient. Unlike Perkaglycerin it could also be used in combination with tar and tannic acid derivatives. The use of the substance persists up to the present day as an antifreeze agent for cars, well known under the trademark Glysantin (BASF).[24] Sugar solutions were also partly able to substitute for glycerin and to serve pharmaceutical purposes. There were different syrup-like products useful for external preparations or enemas. 'Mollphorus' was a mixture of sucrose and invert sugar with high viscosity. In concentrated form it did not crystallise and was also stable against microbial deterioration.[25] Other glycerin substitutes included preparations made of plant mucilage, such as from Agar-Agar, Carrageen, Althaea root, quinces or linseed. They were not universally useful and always needed preservatives like boric acid. Combinations were also offered like the trade-marked 'Glycerinova' containing mucilage, potassium lactate, and calcium chloride.[26] Besides Glysantin, which almost totally replaced glycerin as a technical anti-freeze and lubricating agent, all these developments did not survive the war for a significant time.

Malaria prevention and treatment

From a today's perspective it might sound strange that fighting malaria was a major concern of German troops in the late 19th and early 20th century. However, the tropical disease was still relevant in Southern Europe and North Africa and troops positioned there regularly suffered from the disease at that time only treatable with quinine. Quinine had already been in short supply during the American Civil War and several suggestions for local substitutes were made. Those included the external use of turpentine oil or domestic medicinal plants like dogwood, poplar or tulip tree.[27] During WWI malaria was still prevalent in Southern Europe, the Balkan states and Northern Africa. Among the German army, the malaria incidence was estimated to be 13% for troops positioned in the Balkans and 18% for those in Turkey.[28] Originally quinine came from Britain via the Netherlands, a supply chain which was soon cut off. It seems however, that a significant amount of material persistently came over via the black market. For the German troops in Africa, at least in the beginning, sufficient amounts of quinine were available which, however, soon faded, while no further supply from the North could be expected. Thus, military pharmacists felt the need to extract quinine out of local *Cinchona succirubra* plants. We know details from a biographical sketch written by the German military pharmacist Rudolf Schulze, garrisoned in Dar es Salaam, East Africa.[29] Already in 1915, he started to experimentally extract quinine from local resources and could soon process more than a ton of succirubra root. In the following years he had to use all his pharmaceutical creativity as a production facility had to be established under rather primitive conditions right out of nothing. In the beginning, solvents and glass materials were readily available but the extraction procedure became more and more complex. Soon he had to switch from glass balloons to wooden barrels or iron bins. Moreover, cinchona stocks as well as the whole production plant had to be removed several times and hidden from the approaching enemy. One day he entered an abandoned railway station and constructed an extractor using vacuum brake chambers of the railcars. Heat for the extraction process was delivered by the engine of a discharged locomotive. This worked for a while until again, the place had to be given up due to advancing hostile troops. At the end, Schulze was only able to produce a rather primitive decoction which was, however, still useful in treating malaria. All this, he stated, was obviously better than British quinine tablets which had been compressed so hard that no effect could be expected. From 1000 kg quinine preparations used in Schulze's East African military company, 300 kg had been derived from local, extemporaneous production.

The need for quinine substitutes clearly stimulated the active search for synthetic antimalarials which had begun in the 19th century, but did not succeed until the 1920s, when the Bayer company launched plasmoquine followed by chloroquine in 1934.[30] In his study on the history of synthetic antimalarials, David Greenwood stated:

> During the war, the shortage of quinine impaired the efficiency of the German forces especially in the East Africa Campaign. It is doubtful if any of the synthetic antimalarials in use would have been developed had not Germany been deprived of all sources of quinine during the First World War.[31]

Not every military pharmacist had been so successful as Rudolf Schulze had been, whose efforts are certainly an outstanding example of pharmaceutical creativity in wartime. Although not being proven in detail, one might assume that in every single pharmacy professional knowledge was used to maintain pharmaceutical services for the benefit of patients as far as possible. German pharmacists of the early 20th century were still used to making medicines rather than just relying on industrial products.

Conclusions

It can be concluded that during WW I, in pharmacy as in any other economic area, serious shortcomings had to be conquered. In particular, a shortage of imported medicinal plants and of fat seriously compromised pharmaceutical services. Thus, at all levels of the supply chain, alternative production methods or substitution products had to be found. Industry, for example, switched their production processes for glycerin or camphor. The staff of local pharmacies were still used to manufacturing and were more or less able to cope with the situation by a

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great deal of professional creativity. It also seems probable that the decentralised structure of pharmaceutical services in Germany was an advantage in the way that stockpiles existed at each level of the supply chain and that pharmaceutical services did not largely depend on only a few big suppliers but were delivered by a great number of experienced professionals distributed all over the country. In the 1919 annual report of the German Pharmaceutical Society it was indeed stated that an adequate supply could have been maintained during the four years of war. The author, however, seriously doubted if pharmacists could have succeeded for additional years.[32] While most procedures and products introduced as substitutes vanished in times of peace and free trade, wartime necessities catalysed some important developments like those of synthetic antimalarials or the total synthesis of alkaloids. Some products well known today like Glysantin or dithranol, are directly related to the economy of scarcity a hundred years ago.

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Local

East Riding of Yorkshire Archives and Local Studies Service, The Treasure House, Champney Road, Beverley HU17 9BA. TW Fields, chemists, Beverley: records (closed for conservation) c1950-1979 (6351)

Edinburgh City Archives, Corporate Governance, City of Edinburgh Council, City Chambers, High Street, Edinburgh EH1 1YJ, Scotland. Smith & Bowman, dispensing chemists, Edinburgh: sales ledger 1896-1906 (Accession 931)

Enfield Local Studies Library and Archive, First Floor, Thomas Hardy House, 39 London Road, Enfield, Middlesex EN2 6DS. Thomas Morson & Son Ltd, Manufacturing chemists, Enfield: photographs, catalogues and advertising material 1900-1960.

Essex Record Office, Wharf Road, Chelmsford, Essex CM2 6YT. John William Baugh, chemist, Chipping Ongar: prescription book 1908-1912 (Acc. A13554)

Flintshire Record Office, The Old Rectory, Rectory Lane, Hawarden, Flintshire CH5 3NR, Wales. Clariant Life Science Molecules (UK) Ltd, chemical manufacturers, Sandycroft: photographs, annual reports, company profile 1999-2003 (AN4791)

Gloucestershire Archives, Clarence Row, Alvin Street, Gloucester GL1 3DW. Bream pharmacy: prescription books and accounts 1926-1980 (D13333), VCW Garraway, pharmacist, Cainscross: prescription books, registers and cash books 1934-1975 (D13317)

Hampshire Archives and Local Studies, Hampshire Record Office, Sussex Street, Winchester SO23 8TH. HK Ross, chemist, Aldershot: records incl prescription registers 1927-1969 (135A13)

Hertfordshire Archives and Local Studies, CHR002, County Hall, Pegs Lane, Hertford SG13 8EJ Sheffield Pharmacies, Hertford: records, incl detailed prescription books 1913-1987 (Acc 5485)

Highland Archives: Lochaber Archive Centre, Lochaber College, An Aird, Fort William PH33 6AN. Scotland. Macfarlane & Son, chemists, Fort William: additional prescription books 1926-1948 (L/D114)

Isle of Wight Record Office, 26 Hillside, Newport, Isle of Wight PO30 2EB. Philip Henry Millidge. chemist, Newport: prescription books 1907-1926 (2013/076).

Somerset Heritage Centre, Brunel Way, Norton Fitzwarren, Taunton, Somerset TA2 6SF. Libbis Napier Burch, pharmacist, Chard: morphine, diamorphine, cocaine, eggonine and medicinal opium registers (transferred from Chard Museum) 1921-1932 (A\BEN)

Teesside Archives, Exchange House , 6 Marton Road, Exchange Square, Middlesbrough TS1 1DB Imperial Chemical Industries (General Chemicals) Ltd: papers rel to research and development, chemical products, mergers and acquisitions, photo album rel to royal visit to Wilton site c1950-1989 (Acc 7223, Acc 7228)

West Yorkshire Archive Service, Bradford, Prince's Way, Bradford BD1 1NN. Bernard Keegan, chemist: corresp regarding patent application, incl letter from the War Office regarding dyeing khaki 1914 (WYB597)

National

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Royal Botanic Gardens, Kew, Library and Archives, Kew, Richmond TW9 3AE. Phytochemical Society of Europe: additional corresp, minutes, proceedings, abstracts from symposia and meetings, photographs, membership details, awards and grants information, publication information, conference organisation notes c1970-2010 (PrP 13-0033)

Special

Aberdeen Medico-Chirurgical Society, Medical Centre, Foresterhill, Aberdeen, Aberdeenshire AB9 2ZD, Scotland. Morrison's Pharmacy, Inverurie: pharmacy ledgers c1950-1979 (Acc no 18)

Wellcome Library, Archives and Manuscripts Section, 183 Euston Road, London NW1 2BE. WH Foxhall, chemists, Tunstall: recipe and formulae book 1890s (MS.8896); Manuscript Pharmacopeia: mid 17th century manuscript in Latin containing numerous receipts and family accounts c1650-1750 (MS.8873); Pharmaceutical recipe book 19th cent (MS.8876). Book of medical recipes indexed and kept in several similar hands with many of the recipes bearing attributions, some to well-known physicians 18th cent (MS.8910)

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Thomas Skinner: A Pioneer in Homeopathic Pharmacy

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Although not a pharmacist, the Scottish physician Thomas Skinner nevertheless became a pioneer in the field of homeopathic pharmaceutics. The preparation of remedies was not his major interest – it came about when practising homeopathy following the rules of the founder of homeopathy, Samuel Hahnemann (1755–1843), who recommended that every physician should prepare his own remedies.[1] This principle of 'self-made' remedies became for Hahnemann and many of his fellows an irrefutable rule for homeopathy. Therefore it was a logical consequence for Skinner to catch up on the manufacture of remedies. This lead to the development of a production process which was in use up to the end of the 20th century.

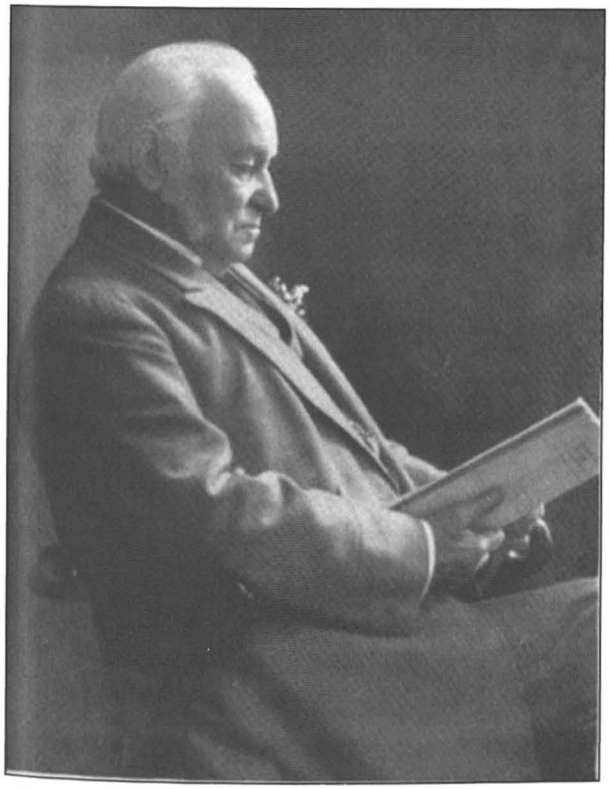

Figure 1. Thomas Skinner. In Clarke JH. Reference 2.

Thomas Skinner was born August 11th 1825 at Salisbury Road, Newington, Edinburgh, as the second son of the solicitor John Robert Skinner. After leaving school in 1849, he began the study of medicine at the University of Edinburgh and at the Royal College of Surgeons of Edinburgh. In 1854 Skinner gained the first medical qualification and in 1857 he became MD at the University of St. Andrews. In the meantime he had become a private assistant to James Young Simpson (1811–1870) and he took up Simpson's enthusiasm for chloroform. His contribution to anaesthesia ended up in the invention of an inhaler ('Skinner's Mask') and a drop tube ('Skinner's Drop-bottle').[2]

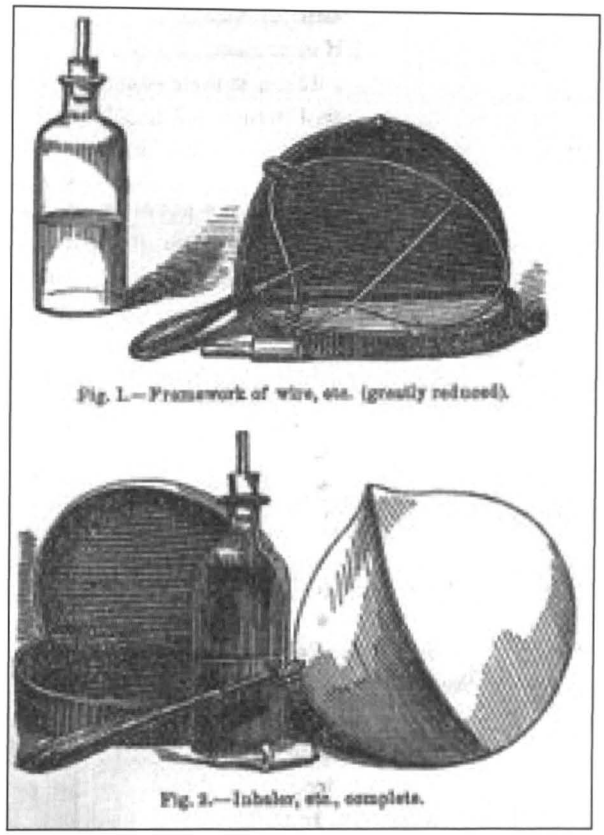

Figure 2. Skinner's Mask. In Skinner T. Reference 2: 15.

While working with Simpson he was involved in discussions about homeopathy, and Skinner took part in Simpson's criticism of the new healing system[3] and later he wrote that he

> was one of the physicians in Liverpool who took an active part in persecuting or attempting to put down homoeopathy … so great was my abhorrence of homoeopathy.'[4]

When practising in Liverpool Skinner, as a consequence of influenza, suffered from an almost complete insomnia for about three years, which made him unable to work. He could not find any release until he met the homeopath Edward William Berridge (1844–1920).[5] Despite his thoughts against homeopathy he consulted Berridge who cured him with a single dose of Sulphur. Deeply impressed by this experience,[6] Skinner started to study Hahnemann's writings and began to practise homeopathy secretly until 'he had made his ground sure'. After 25 years of 'old school' practice he totally changed and abandoned allopathic remedies completely.[7] Skinner became a very prominent homeopath, obvious from his large number of publications.[8] He published the international journal *The Organon*, wherein he was supported by famous American homeopaths that he met personally in 1876 in Philadelphia on the occasion of the first International Congress for Homeopathy.[9] In Philadelphia Skinner became acquainted with Bernhard Fincke (1821–1906) who had invented a certain type of remedy preparation,[10] which had been patented in 1869 by the US patent office.

In 1881 Skinner moved to London where he carried out a large practice for a quarter of century. He was an

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assistant physician to the London Homoeopathic Hospital, which still exists today. Skinner was of good health and died only two weeks after he had slipped on a banana skin on October 11th 1906.[11]

From the very beginning when practising homeopathy Skinner preferred using remedies at higher potencies. This fact can be considered as a common trend, especially in American homeopathy.[12] The preparation of higher potency remedies cannot be done by following Hahnemann's instructions exactly. Hahnemann mainly used the C 30 and C 60 potencies, which means that the original remedy had been diluted at 1:100 and succussed 30 or 60 times. For this he needed 30 and 60 potentizing vials. Due to the development in homeopathy higher potencies were shown to be very effective, and remedies from C 200 up to C 8000 had been successfully used. Of course it is not very economical preparing them the traditional way and using a new vial for every potentizing step. Fincke was the first to solve this problem by the construction of an apparatus for the preparation of the so-called high potencies. Skinner knew about this new principle and he built his first apparatus, which he called a 'fluxion-attenuator' and made it public in 1880. (Figure 3.)

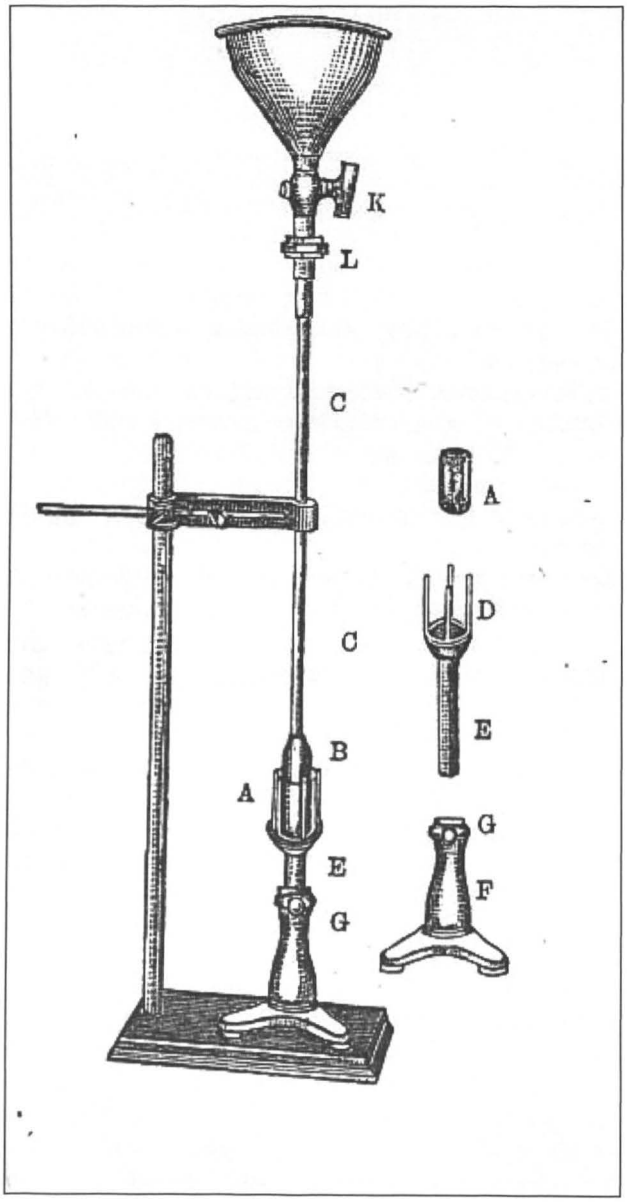

Figure 3. Skinner's Apparatus. Reference 14: 320.

The function of the apparatus is based upon Fincke's 'fluxion-process', which means a continuous flow of water through a vessel.[13] In this case water comes through a copper funnel (after a certain time it will be replaced by the tap) followed by a silver tube, a nozzle and ends in an attenuating glass, which will hold 190 minims. The glass holds one minim of the remedy prepared in advance following certain instructions, which are special for each remedy. The water flows into the attenuating glass with a certain power and causes a perturbation that substitutes the percussion required by Hahnemann to be necessary for a profound mixture of remedy and dilution liquid. When 100 minims of water have run through the glass one potentising step was counted. This apparatus was built at home by Skinner´s son and could have been made for about two or three pounds.[14]

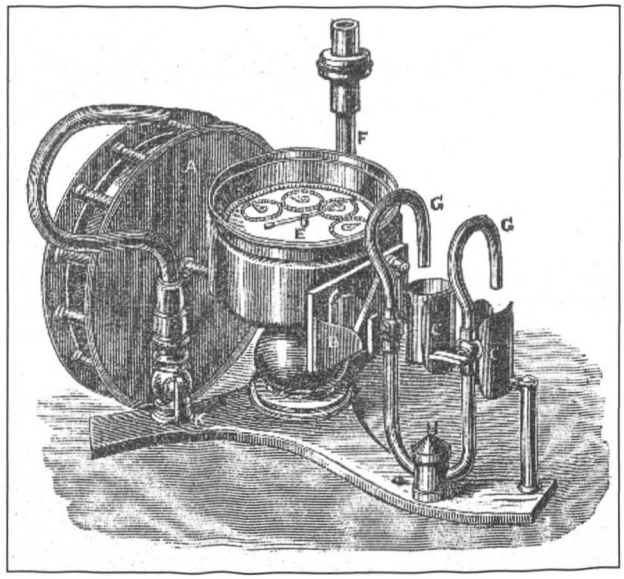

Figure 4. Skinner'a Apparatus. Reference 16: 47.

At this point Skinner developed another apparatus which prepared the remedies in a different way, which meant the water supply was interrupted once the potentising glass was filled up. The apparatus was automatically powered by a water wheel (Figure 4). Whenever the glass is filled with 100 minims it upsets and throws off the content. A certain quantity of remedy remains adsorbed inside the glass to be used to continue the potentizing process. Here also a strong perturbation happens, equalling a succussion. Skinner called these new types of remedies 'interrupted-fluxion' remedies to make a clear difference between the two methods of preparation. The number of the potency reached is registered by an index from one to one million. If the apparatus ran properly it was possible to make '50 centesimal potencies[15] per minute, 3,000 per hour,

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72,000 per day, 100,000 in about thirty-three hours and the millionth in about fourteen days and a half, running night and day'.[16]

Skinner used his apparatus to prepare remedies at the tenth, thirtieth, two-hundredth, five-hundredth, thousandth (1m), five-thousandth (5m), ten-thousandth (10m), twenty-thousandth (20m) fifty-thousandth (50m), hundred-thousandth (Cm), five-hundred-thousandth (Dm) and millionth (Mm) potencies.[17] The remedies were labelled as F.C., meaning 'fluxion-centesimal'. It was possible to buy the remedies at 'Alfred Heath & Co., Homoeopathic Chemists' in London and they were also delivered to the United States.[18]

The machine was made so as to be inserted into an ordinary wash-hand basin,[19] making it practicable for other users. Several other machines had been in use besides Skinner's own. One was modified with some improvements by Skinner himself and went to Toronto, Canada, to Joseph Daniel Tyrrell (1855–1929). In 1887 he offered to potentize every remedy for doctors being a member of the International Hahnemannian Association[20] and not being in possession of a potentizer.[21] Today the original Skinner apparatus is stored at the Faculty of Homeopathy in London.

Another of Skinner's apparatuses was in use and modified by the American homeopathic pharmaceutical company 'Boericke & Tafel' of Philadelphia[22] about 1900. The owners were very satisfied with the remedies obtained by this type of machine after having tested different types of potentizers.[23] The remedies had been proved outstanding. Therefore the construction of a new machine based upon the mechanism of Skinner's apparatus occurred around the 1920s. This time 'Boericke & Tafel' asked a company to design the machine.

With this new apparatus it was possible to prepare six different remedies at the same time. Every potentizing cup is fixed in a separate and sealed chamber. The water is injected through a syringe under high pressure into the cup containing a C 30. The cups rotate and spill out the water. To arrive at the 10 M level it took about one day and for the CM more than four days and more than 100 litres of distilled water. To distinguish the remedies from others, 'sk' (for Skinner) was added to the name of the remedy.[24] (Figure 5)

In later years the machine was validated and complied with FDA's Good Manufacturing Practice standards. From 1991 onward the machine was not in use any longer because the FDA requested a succussion for every potentizing step. This was not possible to perform with the machine, which made the 'succussion' by the violent perturbation following the fluxion-principle. 'Boericke & Tafel' had offered more than 500 high potency remedies.[24]

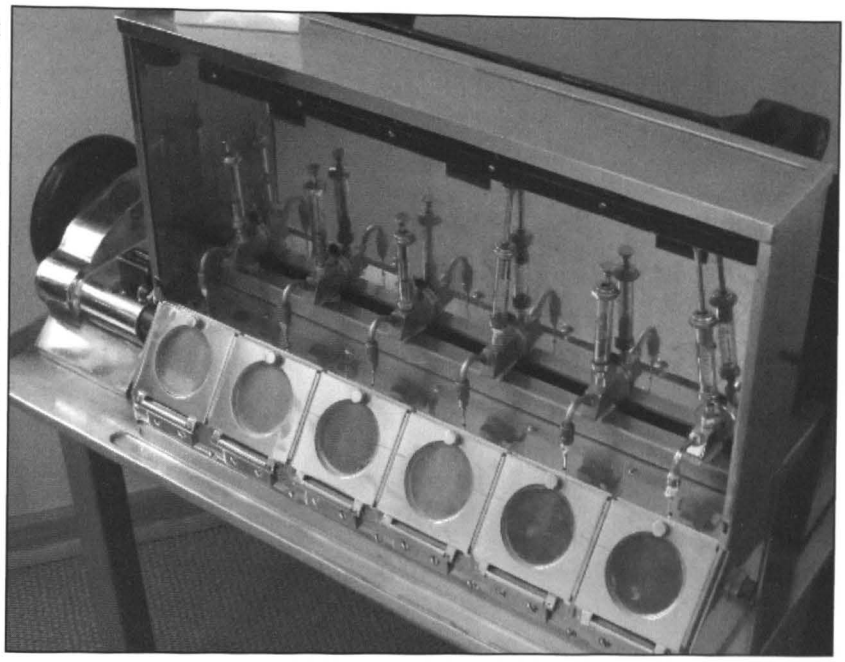

Figure 5. The Skinner Machine Today. Private picture, Dr Gypser.

Conclusion

It has been demonstrated how a homeopathic physician became a pioneer in homeopathic pharmaceutics by coincidence. Neither the pharmaceutical work, the manufacture of remedies nor economic reasons were Skinner´s major interest. His only goal was obtaining well-acting remedies for curing the sick.

Because of the prominent role of homeopathy in America and its physicians prescribing high potencies, it resulted in a pharmaceutical company getting involved with Skinner's remedies. In comparison to other automatically produced remedies they were found more effective so that the company focused all their work on the improvement of the original Skinner apparatus. The technical and scientific development continued and ended up with the construction of a machine that was working up to the end of the 20th century. Skinner's remedies were used successfully in homeopathic treatment worldwide for about a hundred years and Skinner became one of the very few, besides Hahnemann, to play an important role in homeopathic pharmaceutics.

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Endnotes and References

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3. Simpson published a critical work in 1853 under the title: *Homoeopathy: Its Tenets and Tendencies*.
4. Skinner T. *Homoeopathy in Its Relation to the Diseases of Females or Gynaecology*. Porter and Coates, 1875; Clarke JH. Reference 2, 1907: 13.
5. Clarke JH. Reference 2, 1907: 25-27.
6. Clarke JH. Reference 2: 27. Skinner wrote: 'I shall never forget the marvellous change which the first dose effected in a few weeks, especially the rolling away, as it were, of a dense and heavy cloud from my mind'.
7. Clarke JH. Reference 2: 27-28.
8. Around sixty publications are known of which the major part are about homeopathy.
9. The congress was part of the ceremonies for one hundred years of independence of the United States of America, and the congresses are continued until today.
10. Fincke discovered the so-called 'fluxion potencies' and he was the first to prepare true high potencies by an apparatus.
11. Clarke JH. Reference 2: 65, 85, 89.
12. Homeopathy played a very important role in the United States of America until the late 1930s. During the lifetime of Skinner many homeopathic colleges, hospitals and pharmacies had been founded.
13. In contrast to Hahnemann who made the remedies with alcohol, high potencies are made with water; only the last potentising step for reasons of preservation is done with alcohol.
14. Skinner T. The Dynamisation of Medicines. *The Organon* 1880; 3: 319-322.
15. Centesimal potency means it is prepared in the ratio 1:100 of the origin-remedy and the dilution-liquid.
16. Skinner T. Dr. Skinner's Centesimal Fluxion Potentizer. *The Organon* 1878; 1: 45-49, 53.
17. The notation of the potency never was uniform; every manufacturer had its own system.
18. Anon. Dr. Skinner's F. C. High Potencies. *Homoeopathic Physician*. 1884; 4: 82.
19. Skinner T. Dr. Skinner's Centesimal Fluxion Potentizer. *The Organon* 1878; 1: 47.
20. This medical association was founded in Milwaukee in 1880 and most of the leading homeopathic physicians were members.
21. Tyrrell JD, Ballard EA. *Proceedings of the International Hahnemannian Association*. 1887; 8: 16-17.
22. Boericke & Tafel was established by Francis E Boericke (1826–1901) and Adolph J Tafel (1839–1895) in Philadelphia in 1853 and is located today in Santa Rosa, California.
23. It is known that 25 different machines for the preparation of high potencies had been in use at those times in the United States of America exclusively.
24. Anon. High Potency Remedies & Boericke & Tafel. *Homeopathy Today* 1990; 10: 13.
25. Anon. High Potency Remedies & Boericke & Tafel. *Homeopathy Today* 1990; 10: 13.

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British Society for the History of Pharmacy
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British Society for the History of Pharmacy

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The British Society for the History of Pharmacy was formed in 1967 under the aegis of the Pharmaceutical Society of Great Britain, having originated from its History of Pharmacy Committee.

BSHP seeks to act as a focus for the development of all areas of the history of Pharmacy, from the works of the ancient apothecary to today's ever changing role of the community, hospital, wholesale or industrial pharmacist. Membership is open to all interested in the aims of BSHP.

Aims

Promotion of historical studies related to pharmacy.
Advancement of knowledge and propagation of understanding of the history of pharmacy.
Publication of the research work of pharmaceutical historians.
Preservation of pharmaceutical artefacts and historic pharmacies.
Support for the work of relevant museums and offering advice on establishment of other pharmaceutical exhibits and on the preservation of pharmacies.
Co-operation with related professions and local historians on medico-pharmaceutical topics of mutual interest.

Pharmaceutical Historian

The *Pharmaceutical Historian* has been published since 1967, at first intermittently, but on a regular quarterly basis from 1972. Issues generally comprise 20 or 24 pages and cover.

An **index** for the years 1967-1995 was published in 1998, for 1996-2000 in 2000, for 2001-2005 in December 2005 and for 2006-2010 in December 2010. They can be viewed on the website.

Papers, short communications and letters in English on any aspect of the history of pharmacy are welcome and should be sent to the address above or by email to *ainley.wade @easynet.co.uk*

Any illustrations are converted to monochrome for printing. Further details of requirements can be found on the website *www.bshp.org* under Publications.

Membership

Membership costs £20.00 per annum and includes:

Four issues of the *Pharmaceutical Historian*.

Regular meetings, with guest speakers, usually in November, February and May.

Visits to places of historic interest, museums, collections, botanical gardens, etc.

Annual Conference, usually in March/April.

Free use of the Royal Pharmaceutical Society of Great Britain's library facilities for research.

Help in historical research and with the identification of artefacts.

Affiliation to the International Society for the History of Pharmacy (ISHP).

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Application forms are available from the Honorary Secretary at the address above or on *www.bshp.org*

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Please note that from July the evening meetings will be held at the RPS, 66-68 East Smithfield, London E1W 1AW, starting with refreshments at 5.00 pm, unless otherwise stated, The RPS is expected to have moved to its new headquarters by July 2015.

Monday 27 July 2015
Joint meeting with the Friends of the Archives, Society of Apothecaries to view displays of the Museum of the RPS **at its new headquarters** at **66-68 East Smithfield, London E1W 1AW. Refreshments at** 5.00 for 5.30. Details with the meeting notice.

Monday 12 October 2015
'Joseph Banks' by Andrew Sankey. At new RPS headquarters at 58 East Smithfield, London E1W 1AW, 5.00 for 5.30.

November 2015
Joint Meeting with Medway School of Pharmacy. Details to be confirmed.

British Society for the History of Medicine, 26th Congress 2-5 September 2015, Leeds

The congress will be held at Weetwood Hall, Leeds on the themes 'The good, the bad and the unknown (people, events and discoveries)' and First World War Medicine. Preliminary information is available at http://www.bshm.org.uk/Congress.asp?ID=5

International Congress for the History of Pharmacy, Tuesday 8 to Friday 11 September 2015, Istanbul, Turkey

The 42nd International Congress will be held at the Istanbul University Convention Center on the theme of the 'Exchange of Pharmaceutical Knowledge Between East and West'. Further information and booking forms are available at www.42ichp.org

International Society for the History of Pharmacy

The 2014 ISHP newsletter is available at www.histpharm.org/IGGP%20Newsletter_15_2014.pdf

BSHP Annual Spring Conference 2016

The next Conference will be held in the Best Western Reading Moat House, Wokingham, Berkshire from 1st to 3rd April 2016.
The chosen theme is **Pharmaceutical Education,** and papers and posters on this or related topics are requested for the Saturday session.
In addition it has been decided to hold a 'reminiscence' session on the Sunday morning and all members are asked to contribute a 5/10 minute presentation, or poster, on any aspect of their own education or training. It may be something that stood out as a career-changing moment, something that you thought important which seems to have disappeared from current training, a thumbnail sketch of an outstanding lecturer or trainer or just an amusing incident.

If there are sufficient submissions this session will take the place of the guest lecture. Offers of presentations for either session should be sent to Shirley Ellis, 1 Willow Way Bottisham, Cambridge CB25 9BS; e-mail shirleyellis@shirlellis.plus.com.

The **2017** conference will mark the 50th anniversary of the foundation of the BSHP and we hope to make it something special, perhaps in London. Any ideas for topics which you think might attract a wider audience to individual sessions would be welcomed by the Committee.

Correction: By an editorial error the text on pages 18 and 19 of the last (March 2015) issue was transposed.

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A Survey of Artificial Pharmaceutical 'Stones' – Part 2

Christopher J Duffin and Rachael Pymm
Sutton, Surrey and Egham, Surrey

Continued from *Pharmaceutical Historian* 2014; 44 (1): 2-9.

Lapis medicamentosus

This stone, credited to Oswald Croll (circa 1563-1609), alchemist, champion of Paracelsianism and a member of Rudolph II's scientific circle in Prague, is subject to some variation in composition. Earlier recipes are based on Roman vitriol (cupric sulphate), white vitriol (zinc sulphate), alum, cerusse (lead carbonate), lapis calaminaris (zinc oxide or zinc carbonate) and an earth, such as Bole armeniac. Later accounts cite green vitriol (iron sulphate) in place of the blue, the use of common salt and salt of tartar (potassium carbonate), and Anatron of Sandiver. The latter ingredient, also known as Glass-gall was a by-product of the glass-making industry; it was the scum rising to the surface of the melted glass, consisting of various fused salts (especially various chloride and sulphate impurities) that do not combine with the silica.[1] Schroeder's *lapis rubeus dictus* is quite similar to *Lapis medicamentosus*, having litharge, sal ammoniac and albi puri (pure white sugar) as additional ingredients.

Lapis medicamentosus enjoyed a wide range of applications, being 'laid to fasten the Teeth, preserve the Gums, heal and dry up Ulcers and Wounds, ... and in Compositions for sore Eyes.' It also supposedly dried up various discharges and was used in the treatment of erysipelas ('St Anthony's Fire' – a dermal streptococcal infection), itch ('Scabiem'), fistulas, and gangrene, as well as encouraging coagulation of the blood and preventing corruption of the lymph.[2] It seems to have been something of a last resort in terms of its dental applications as mentioned above: John Pechey (1655-1718), the London doctor who often came into conflict with the Royal College of Physicians over his apothecarial style, wrote that 'When the Gums are putrified and corrupted , and the Teeth being carious and loose, stink' or when 'deep and putrid Ulcers afflict the Gums ... stronger Medicines, and such as greatly resist Putrefaction, are to be used ... Lapis medicamentosus is very effectual in this case'.[3]

Lapis medicamentosus was also used in injections 'for stopping a gonorrhoea after the virulence has been expelled'.[4] Jean Astruc (1684-1766; Fig. 1), Professor of Medicine at Montpellier and Paris, and pioneer of the study of sexually transmitted diseases, noted that two drachms of *Lapis medicamentosus* mixed with dried roots of the Common Marshmallow (*Althaea officinalis*), 'to be thrown daily up the Urethra, or Vagina, to take of the relicks of an habitual Gonorrhoea. But be very cautious that you imprison none of the virulency, which may bring on the tragedy afresh ; therefore it is better to abstain from so hazardous a remedy'. In the male,

Figure 1. Jean Astruc (1684-1766). Line engraving by L. Halbron, 1771, after C. Monnet. Wellcome Library, London.

Charles Gabriel le Clerc (1644-1700; Physician in Ordinary, and Privy-Counsellor to Louis XIV) indicated that Lapis Medicamentosus dissolved in Plantain Water was to be injected directly into the penis.[5]

The German alchemist and physician, Adrian von Mynsicht (circa 1588-1638; Fig. 2), used *Lapis*

Figure 2. Adrian von Mynsicht (circa 1588-1638), Line engraving by D. Dirickson. Wellcome Library, London.

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medicamentosus as a simple in a surprising variety of preparations, including

- With *Gum Lacca* (scarlet resinous secretion of some species of scale insects and mealybugs) and burnt alum dissolved in Water of Sage and Roses to form Tincture of Lacca, with which to treat scurvy and 'the laxity and rotenness of the Gums'.
- With mercury, Rose Water and Plantain Water, all dissolved in Aqua Fortis (nitric acid). This was used topically against old ulcers and wounds, 'especially the old sordid Aphrodisia', and was deemed effective at removing 'all Morphew [blemish or mark on the skin, often due to scurvy], Spots, Scurff and Pimples of the Face', as well as treating erysipelas and fistulas. His advice to 'take heed lest you touch the eyes or teeth' seems well placed!
- With alum, green Elder bark, Mugwort, St John's Wort, Cinquefoil, Dwarf Elder, Dill, Maidenhair, salt and Guiacum, all boiled together in river water in order to provide a foot bath (*Balneum medicamentosum sive Lotio pedum*) to treat scurvy and tumours of the foot.
- With Virgin honey, alum, Tincture of Roses and a range of coloured and aromatic ingredients (e.g. coral, myrrh, mastic, Dragon's Blood) to form a medical balsam that was applied to the gums 'when they are putrid, swelled, overgrown and black', to fasten loose teeth and 'amend other vices of the mouth', and to heal 'the Cancer, Noli me tangere ['Touch me not' – often referring to cancer of the eyelids], Scurvy, Imposthume, Ulcers, Corrosion, etc.'.
- With old Hog's grease, white turpentine, sulphur, a range of types of lead, Tutty, Pompholix and a range of other ingredients to make *Unguentum medicamentosum*. This was then used to treat Scabs, running sores, tetters (eruptive skin diseases such as Herpes or eczema), itch, elephantiasis, alopecia, sores on the head and for the removal of scurf.
- With Ashes of Hermodactylus (Snake's Head, a member of the Iridaceae), Asphodel root, Bean stalks, wood of Elder, figs, vine cuttings, and dwarf elder, cummin seeds, Bay berries, cloves, brown bread, vinegar and white wine, and boiled gently to produce the Cataplasm of Ashes. Linen cloths soaked in this mixture were then applied to 'Dropsical tumours and swellings', working in a pathway downwards toward the feet.[6]

By the late 1760s this recipe was being dropped from the official pharmacopoeia; the otherwise anonymous 'M.S.' remarked, in 1744, that '*This composition is a very odd one, very rarely prepared and much seldomer used*'.[7]

Lapis salutis

Lapis salutis or the Stone of Health was detailed in several recipes: a pound each of alum, Hungarian vitriol (?), half a pound each of white vitriol (zinc sulphate), white lead, sandiver, and Armenian bole, four ounces of frankincense and one and a half ounces of myrrh were ground together to form a powder. Alternatively, vitriol, sal nitri, cerusse, bole armeniac and sal ammoniac were blended together. The most enthusiastic recipe is given

Figure 3. Gideon Harvey (circa 1640-circa 1700). Line engraving by P. Philippe, 1663. Wellcome Library, London.

by the Spanish apothecary, Juan de Loeches (dates unknown, but late 17th century) where a range of supplementary ingredients (e.g. absinthe, artemisia, chicory, plantain and myrrh) are added to the usual alkalis.[8] William Salmon's *Lapis medicamentalis* has a composition which is quite similar to *Lapis salutis* : Hungarian vitriol, salt of nitre, cerusse, alum, bole, sandiver and sal ammoniac mixed together in white wine vinegar.[9]

Gideon Harvey (circa 1640-circa 1700; Fig. 3) was born in Holland and studied at Oxford, Leiden and in France before settling as a physician in London. Widely published, his writings tend to be somewhat self-serving, and he claims responsibility for *Lapis salutis* with the following composition:

> Roman and martial vitriols (sulphates of copper and iron respectively), viride aeris (verdigris), cerusse, litharge of silver dissolved in vinegar and thickened with Armenian bole to produce the stone-like consistency.

The stone powder could then be suspended in red wine and applied with beneficial results to 'depascent and dysepulotic Ulcers' (i.e. those which were eating away at the tissues and intransigent to other treatments).[10]

Geoffroy's Stone

Étienne-Francois Geoffroy (1672–1731; Fig. 4), Master Apothecary in Paris reported to the Royal Academy in 1713 concerning some spherical stone-like preparations made by French surgeons and used to treat battle wounds. Iron filings, haematite and Cream of Tartar were

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Figure 4. Étienne-Francois Geoffroy (1672–1731), Line engraving by L. Surugue, 1737, after N. de Largillière. Wellcome Library, London.

ground and mixed together in white wine in order to form a paste. To this was added mastic and saffron, and then the whole confection was dissolved in wine, myrrh and aloes. After thorough mixing, the liquid was allowed to stand and the fluid allowed to evaporate. The precipitate was then moistened with brandy, shaped into balls, dried in the sun and stored in stoppered bottles. When the medicine was needed, a ball was soaked in wine or brandy (or in the absence of both, fresh urine) to form an infusion. Subsequent treatment depended on the severity and depth of the wound; simple cuts and scrapes were washed with the fluid, deeper cuts had the tincture injected directly into the wound, and arterial cuts warranted the spheres being pressed directly into the wound and compresses soaked in the tincture used to cover it. The tincture was also applied to intransigent ulcers, supposedly with beneficial results.[11]

Lapis divinus

Lapis divinus is a term that has been applied to two stones, one naturally occurring, and the other artificial. Nephrite jade, sometimes also referred to as *lapis nephriticus*, occurs in some materia medica collections (e.g. John Burges Materia Medica Collection at the Royal Pharmaceutical Society Museum, specimen 1063), and was used amuletically to guard against and remove a wide variety of renal calculi, particularly bladder stones, and to ease the bites of insects.[12]

Directions for the manufacture of artificial *Lapis divinus* involved melting together alum, saltpetre and vitriol of Cyprus in a glazed earthenware vessel placed in a charcoal furnace. As soon as the mixture began to seethe, camphor was added and the whole unit sealed. After 24 hours, the pot was broken to extract the 'stone' inside, which was then stored in a stoppered glass bottle. When required, up to half a drachm of the stone was powdered into half a pint of water, to which was added sugar candy and a spoonful of brandy.[13] The identity of vitriol of Cyprus is not absolutely clear; both Dioscorides (first century AD) and Pliny the Elder (AD 23-79) referred to vitriol forming as white dripstones in caves, mine tunnels and pits in the vicinity of copper ore deposits on Cyprus, which suggests that blue vitriol or copper sulphate was meant.[14]

Helcoma, a corneal ulcer, was supposedly cured by irrigating with a solution of *lapis divinus*, which was also recommended in several varieties of ophthalmia (with pimples and abscesses on the cornea, or ulcers on the eyelid). It was also used in cases of gonorrhoeal ophthalmia, characterised by purulent conjunctivitis, and otorrhoea (discharge from the ear).[15]

The famous French ophthalmologist, Charles de Saint-Yves, (1667–1731) used solutions of *lapis divinus* extensively in his work. De Saint-Yves learned medicine and surgery in his position at the pharmacy of the Priory of St Lazarus, part of the Roman Catholic institution of priests and brothers known as the Congregation of the Mission. Leaving the Priory in 1711, he set up his own practice in Paris, becoming well known, especially for his work with patients suffering from cataracts. His treatment of a French farmer's wife with long-term ophthalmic problems involved removing the greater part of the globe of the eye when her life was threatened by the high fever, extreme headaches and beginnings of gangrene in an eye which was bulging from the orbit; part of the post-operative treatment involved washing the wound with a solution of *lapis divinus* three times a day. He also used it in cases of what he referred to as 'Nail or Pterygion', a wedge-shaped fibrosis growing inward from the conjunctiva and distorting the cornea, as well as in the various types of ulcer listed above.[16] As an ophthalmic remedy, *Lapis divinus* was still being used well into the mid-nineteenth century.

Lapis infernalis

Lapis infernalis or the Infernal Stone (also referred to in various works as Lunar Caustic, *Lapis septicus*, *Lapis coelestis* and the Chirurgical Stone) is the subject of considerable variation in terms of its content. John Quincy gives three recipes for this highly caustic preparation:[17]

1. Evaporated 'strongest soap lees' (lye or sodium and potassium hydroxide).
2. Calcined vitriol and tartar, quick lime (CaO) and sal ammoniac, boiled together in water, strained and evaporated.
3. One part quick lime to two parts potash or calcined tartar, infused in hot water for five or six hours, boiled, strained through brown paper and evaporated.

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LeClerc, however, suggests dissolving one part silver in three parts spirit of nitre (nitric acid) and boil, reducing it to one third of the original volume before pouring into a mould and allowing the residue to set.[18] One such mould is described and illustrated by Nicholas Leméry (1645-1715) in his *Cours de Chimie* (1675).[19]

The corrosive (escharotic) preparation was used as a cautery to remove dermal 'excrescences', warts, penile and preputial gonorrhoeal ulcers ('skankers') and 'carunculae', cankers, gangrene, tumours, 'caries of the bone', fistulae, abscesses, carbuncles, ulcers in sufferers from the King's Evil, and excess post-operative tissue associated with removing lachrymal fistulas or 'fungous carnosities' associated with lithotomy.[20] Mixed with distilled Oil of Tobacco and placed for a short time on the surface of the abdomen, it was used topically to provoke vomiting.[21] The Cork physician Edward Barry used repeated applications of *lapis infernalis* to remove testicular tumours; he used oil of vitriol to ameliorate the pain suffered by the patient during the treatment![22]

Lapis seu Sal Prunellae

Nicholas Culpeper (1616-1654) describes the production of this stone as heating pure saltpetre in a crucible and slowly adding yellow sulfur.[23] It was supposedly therapeutic in cases of toothache, inflammation and bucco-pharyngeal sores, as well as being taken inwardly in cases of hot fevers (such as attended cases of plague), worms and kidney stones. Incorporated into a liniment with brimstone, Salt of Saturn (lead acetate) and 'Oyl of Rape', it was also used to treat 'Rebellious Herpes'. *Lapis prunella* was even used in cooking, as part of the lengthy process of preparing 'Dutch Beef'.[24]

Figure 5. Ferdinand Verbiest (1623-1628). Detail of an engraving by J. van Solingen, 1736. Wikimedia Commons.

Lapis attrahens venenum

In addition to the artificial stones detailed above, Johann Helfrich Jungken (1648-1726) lists *Magnes arsenicalis* based on Hungarian antimony, brimstone and arsenic, which was either worn amuletically or as a plaster; supposedly it worked magnetically, drawing poisons out of plague victims.

Lapis attrahens venenum – the Poison Attracting Stone – also cited by Jungken, presumably worked in a similar fashion against the bites of venomous animals, and was based on poisonous secretions from toads, viper jelly and terra lemnia.[25]This appellation is also found in a treatise by Ferdinand Verbiest (1623-1688; Fig. 5), a Flemish Jesuit missionary to China, probably more famous as an astronomer and seemingly the designer of the first ever self-propelled vehicle. Verbiest's treatise is entitled *Hsi-tu-shih yuan-yu yung-fa* ('The origin and usage of the stone that attracts the venom') and is thought to have been composed circa 1686.[26] His text advises that the Poison Attracting Stone should be prepared from flesh of the viper, earth (perhaps terra sigillata) and the stone taken from the head of a snake in India.[27] The latter is the snakestone or *lapis serpentinus*, which has, itself, been the subject of much debate, particularly over its origin and composition, as well as its supposed therapeutic effectiveness. Many, including Verbiest, credulously assert that it is a stone taken from the head of certain species of snake and consider this to be the 'natural' snakestone. German Jesuit scholar Athanasius Kircher (1601/2-1680), a possible source for Verbiest, also seems to credit the existence of a 'natural' snakestone, retrieved from the head of a snake, as well as an 'artificial one which can be made of little crushed stone fragments from the snakes' heads, hearts, livers and teeth. These portions are mixed with some special kind of earth'.[28] However, one of the earliest seventeenth-century travellers' accounts which reference the snakestone describes it as being composed of the ash of burnt roots and the earth of a city in India - the country in which the snakestone tradition may have originated - named Diu:

> In this Town of Diu the so much famed Stones of Cobra are made, they are composed of the Ashes of burnt roots, mingled with a kind of Earth they have, and once again burnt with that Earth, which afterwards is made up into a Paste, of which these Stones are formed.[29]

Generally, snakestones were thought to be effective against the bite of venomous animals, especially snakes, as they were believed to draw the venom from the bite; the stone's ability to adhere to a wound inspired confidence in this theory. More detailed discussion of the snakestone will be given elsewhere.

Conclusion

The 17th century and the first half of the 18th century, during which time Paracelsianism was progressively replacing the more traditional tenets and prescribing practices of Galenism, marked a time of considerable innovation in the production of artificial medicinal 'stones'. These dried, ball-like additions to the panoply of apothecarial preparations had the advantage that, once

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manufactured, they were stable, easily transported and stored (usually in sealed or luted glass containers), had a relatively long shelf life, and could be administered easily with standardised dosage in powdered form suspended or dissolved in a suitable medium and, often, the solution itself also kept for several weeks. The nomenclature of these preparations provided a comfortable link with the popular geological and sometimes zoological simples that were a feature of the more highly folkloristic medical traditions of the Middle Ages and enshrined in many materia medica and pharmacopoeias.

Acknowledgements

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Peganum Oil in Iranian Traditional Pharmacy

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In Iranian traditional pharmacy, not only were oil=bearing plants used to produce medicinal oils, but also every part of the plant could be used. Peganum oil is a good example of this kind which was prepared by processing the seeds of *Peganum harmala* L. with an oily vehicle. This paper introduces this oil and its medical uses as well as the preparation method from the pharmaceutical traditional treatises called *Qarabadins*.

Introduction

Oils are ancient forms of medicine[1] which were used traditionally in Chinese, Greek, Egyptian and Indian systems for example.[2] This dosage form is also an important part of the Iranian traditional pharmacopoeia. Oils are still a popular remedy among the people and available in traditional herbal markets (*Attari*). Many different kinds of oils with various therapeutic properties are mentioned in traditional medical and pharmaceutical treatises. A *Qarabadin* (Pharmacopoeia) is a kind of pharmaceutical treatise that includes details of modes of preparation, combination, preservation and administration of dosage forms. It may be a part of a larger treatise like the 5th book of Avicenna's *Canon of Medicine*, or in most cases an independent work such as *Qarabadin Salehi*. It persisted as a pharmacological form well into the nineteenth century.[3] Usually this kind of treatise has been written according to dosage forms in alphabetical order. The *Qarabadin Salehi*, *Qarabadin Kabir*, *Qarabadin Shafayi* and *Qarabadin Azam* are the most important *Qarabadins* in Iranian Traditional Pharmacy.

One of the main parts of this type of treatise is Oils (*Roghan* in Persian or *Dohn* in Arabic). Traditional oils could be divided into mineral, animal and herbal oils, with herbal oils forming the major part. They could be used orally or topically. The interesting point about herbal oils is that they were not only produced from oil-bearing parts of the plant, but they could also be prepared from every part of every plant.[4] Depending on the herb type and part, different ways of preparating oils were used,[4,5] of which some are comparable to modern ways.[6] This paper introduces one of these oils, Peganum oil, as well as its traditional medical uses. Recently, the oil was prepared in the traditional way to evaluate its appearance.

Figure 1. A traditional herbal market in Shiraz, Fars, Iran. (Photo by authors)

Peganum Oil

Traditional treatises mention Peganum oil prepared from seeds of *Peganum harmala* L. This plant is a native herb of dry areas from the Zygophyllaceae family.[7] The Persian name (*Esfand* or *Espand*) is derived from the ancient word *Sepanta* meaning pure and holy. It was first described by Dioscorides as '*Peganon agrion*', and later Greek authors mentioned it as '*Persaia botane*'. The genus name is derived from the ancient Greek name of the plant. The specific *harmala* refers to the Syriac name of the plant (*Hormal*), which is still used as its Arabic name.[8] In addition to various medicinal properties mentioned in Iranian medicinal treatises for *P. harmala* (Figure 2), the oil

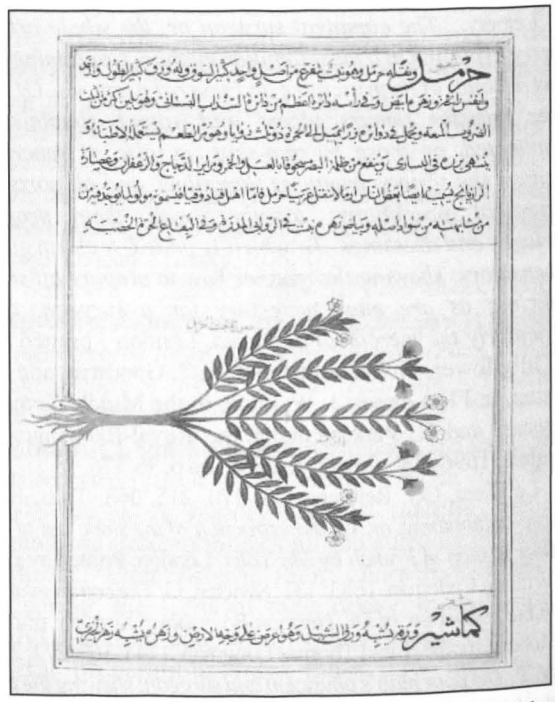

Figure 2. Page of Arabic translation of Dioscorides *Materia Medica*, *Al-Hashayesh*[10] which contains a monograph on *Peganum harmala*.

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processed with its seeds also had been shown to have therapeutic properties. Topical or oral use was considered aphrodisiac. It also was used in hearing problems, paralysis (*Falej*), facial palsy (*Laghve*), tremor (*Raashe*), sciatic pain (*Ergh-ol-nasa*), backache and other kinds of musculoskeletal pain such as joint pain.[4,5] This medicine was used by the rectal route as an enema for some kidney and uterus disorders caused by cold temperament.[9]

Table 1. Changes in acidity, peroxide value, iodine value and saponification value of oil.

Sample	Acid value (% as oleic acid)	Peroxide value (meq/kg oil)	Iodine value (g of I_2/100 g oil)	Saponification value (mg KOH/g oil)
Olive oil	1.01±0.1	11.50± 1.12	90.21±2. 85	191.82± 5.63
Peganum oil	3.85± 0.24	13.38± 1.46	91.83± 2.05	201.23± 6.78

Preparation of Oil

According to *Qarabadins*, there were two different ways for preparing Peganum oil (Figure 3). In the first method, which was the most common one, the seeds should be ground and macerated in water for one night, then boiled till the seeds soften and all the strength of the seed transfers to the water. Then it should be filtered. The aqueous extract is then mixed with an oily vehicle like almond, olive or sesame oil and boiled on a gentle fire to evaporate all the aqueous part The ratio between seeds, water and oil is 1 to 6 to 1.5 by weight.[4,5] Sometimes, before boiling with oil another herb was added to this formula, like the juice of *Raphanus* spp. (radish).[5]

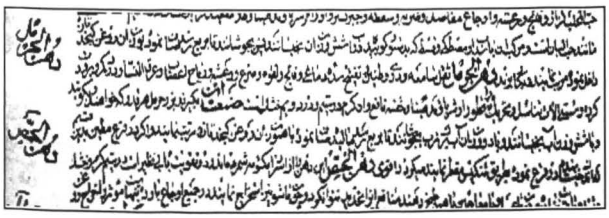

Figure 3. Page of *Qarabadin Kabir* (18th century) on therapeutic uses and preparation of Peganum oil.

In our attempt to prepare peganum oil, olive oil was used as the oily vehicle. The interesting point is that according to traditional treatises the last step of oil preparation (boiling the aqueous extraction with oil) should be necessarily done in a stone, copper or iron pot.[4] The use of a glass jar in our work resulted in a reddish two-phased turbid oil. But by using a copper or iron pot, a red clear odourless oil was obtained.

The other method used for Peganum oil preparation was called *Tankis* ( ),[5] which is a method known as reversed distillation.[11]

Basic Analysis of the Oil

For investigation of the changes in oil standard values, four typical tests, including acid value, peroxide value, iodine value and saponification value, were performed according to the pharmacopoeia standards for olive oil (the oily vehicle for the base) and prepared Peganum oil. Each test was performed 3 times for each sample (Table 1).

Discussion and Conclusion

Oils are among the main topical dosage forms of traditional medicine and pharmacy in many countries.[1] The therapeutic impact of some of these dosage forms in folk medicine may be a reason to reestablish the preparation in current medical approaches. On the other hand oils, especially rubbing and massaging types, are still popular among traditional practitioners with cultural beliefs. Their ease of preparation and administration as well as rapid absorption via massaging on the area are some advantages which make the dosage form a convenient and highly applicable pharmaceutical form in traditional medicine. But pharmaceutical research and precise analytical methods of determination for this dosage form are scarce.[6]

However, remaking a traditional preparation should be performed in correspondence with the cited procedure.

Figure 4. Distillation method which is traditionally used in Iran. (Photo by authors)

Otherwise, clinical evaluation may lead to uncertain or undesirable results. As a topical remedy in neurological and painful conditions, peganum oil is a traditional preparation from a traditional pharmaceutical manuscript. In our work, the oil was prepared by the procedure employed in the manuscript and a red transparent oil formulation was obtained. With reference to the boiling process, some semi-lipophilic constituents of Peganum may be trapped in the oil phase following aqueous phase evaporation. On the

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other side, amounts of heat-sensitive ingredients extracted in the water phase may decompose via overheating. This fact may have resulted in the elevation in acid or peroxide value compared to the olive oil.

Other than the historical clarifications, peganum oil presented and prepared in this research can be submitted for clinical evaluation.

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Intranasal hypnotic drugs used in Iranian Traditional Medicine (ITM)

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Insomnia is a common sleep disorder and oral sedative drugs are the most commonly used in allopathic medicine for its treatment. In Iranian traditional medicine (ITM), different drugs are used for the treatment of insomnia, as well as in other schools. One of the most important characteristics of ITM is that it recommends the use of non-oral drugs to treat insomnia. In this method, not only are gastrointestinal adverse effects of drugs eliminated, but also in many cases speed of efficacy of the drug increases compared to oral the method. In ITM one of the best methods of giving drugs in neurological diseases such as insomnia is the nasal route. Nasal drugs are used in traditional medicine in various forms. The aim of this study is the investigation of some inhaled hypnotic herbs and description of their administration in ITM. This study is a review of literature based on credible ITM textbooks. The present study collects some of the inhaled hypnotic herbs which are used to treat insomnia in ITM and describes all non-oral methods of their administration. Since intranasal drug consumption is one of the principal treatment routes for insomnia, a description of the method and introducing current herbs for insomnia can be considered as sections of principal treatment in different clinical studies and even as complementary medicine alongside modern current treatment methods.

Introduction

Insomnia is the most common sleep disorder. Almost 30 percent of people in each society suffer from insomnia in some period of their life, while 10 percent of them exhibit chronic insomnia. Furthermore, insomnia is usually more prevalent among elders, females, divorced people, widows and those who suffer from other physical or psychological diseases.[1] Insomnia affects other aspects of life as well. To name a few, fatigue, day-time drowsiness, reduced memory and concentration, depression, anxiety, high sensitivity and irritability, work disturbance and reduced life quality, are among side effects of insomnia.[2] Benzodiazepines are frequently prescribed to treat insomnia but they increase the probability of adverse effects such as slowness, sleepiness, fatigue, nervousness, forgetfulness, headache, irritability, dizziness, aggressiveness, change in sexual drive and confusion.[3] GABA is the main inhibitory neurotransmitter in the central nervous system and

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benzodiazepines intensify GABA inhibitory effects in all nervous levels. But 5-HT, dopamine neurotransmitter and nicotinic and muscarinic acetylcholine receptors also affect the sleep mechanism.[4] In ITM, non-oral treatment methods, specially inhalation, are used very often. Old Iranian traditional physicians believed that in neurological diseases inhaled drugs work faster than oral drugs due to the speed of reaching the brain.[5] This study is a survey which investigates different credible textbooks of Iranian traditional medicine. It collects all the herbs that are used in the form of inhalation as a hypnotic for insomnia and expresses their hypnotic mechanism. The aim of this study is to find new and safe solutions to treat insomnia by recognition of some different inhaled hypnotic herbs which are used in ITM.

Method and materials

In this review, we studied printed versions of the most important ITM books, such as *The Canon of Medicine* by Avicenna (10th-11th centuries), *Exireazam* by Cheshti (19th century), *Tohfat Al-momenin* by *Tonkaboni*(17th century) and *Makhzan-al-advie* by Aqili (18th century), etc. These books are important clinical or pharmaceutical texts which have been widely taught in traditional medicine schools in Iran.

In ITM insomnia is considered to be a neurological disease. We searched the term insomnia in the neurological diseases chapters of the clinical textbooks in ITM. Then, by using the pharmaceutical texts, we found all the herbs prescribed for the disease intranasally. In addition, some other books such as *Matching the Old Medicinal Plant Names with Scientific Terminology* and *Popular Medicinal Plants of Iran* were studied for nomenclature of medicinal plants. Additionally, for all herbal remedies, an extensive search of scientific data banks such as Medline was performed to find related works concerning the improvement of sleep using these plants and the results were sorted alphabetically in a table.

The principles of insomnia treatment from the viewpoint of Iranian Traditional Medicine

From the perspective of traditional medicine, the main principle of treatment is the elimination of the causes of disease. Improvement of the affected organ's temperament is recommended in the next stage. Since the main reason for insomnia was considered to be dryness or hotness along with dryness in the brain, ITM physicians suggested wetting the brain as the treatment. The wetting process can be done by eating moisturising foods, taking herbal drugs or physical activities such as massage.[6]

ITM physicians' views on insomnia treatments can be divided into two sections:

1) Non-drug treatments or sleep hygiene, which are essential for health. Eating moisturising food, not eating desiccant food, relaxation, tempering bath, massage, listening to beautiful songs, avoiding bad thoughts, and lack of coitus are among these treatments.[6]

2) Treatments by drugs which can be taken either orally or non-orally.

Non-oral (local) treatments in ITM

Inhalation: Putting very fluid liquid in the nose.
Prostration (incense): Boiling drug in water and keeping the head in its vapour.
Fumigation: putting medication on a fire and inhaling the smoke.
Anointing: Unction.
Olfaction: Smelling aromatics.
Plaster: rubbing the paste on the member and dressing it.
Liniment: rubbing a thin lotion on the member.
Drops: dropping the drug as a liquid in the nose.
Douche: pouring medicinal liquid on the affected organ by force.
Snuff: pounding dry medication and insufflating in the nose.[7,8]

Among the above methods, inhalation, prostration (incense), fumigation, olfaction, drops, and snuff are inhaled forms of drugs and have an effect intranasally. This procedure is used to treat neurological diseases in ITM and accelerate the drug's efficacy; it has fewer gastrointestinal side effects compared to oral formulations. Since insomnia is a neurological disorder, ITM physicians recommend these methods for its treatment.

Mechanism of hypnotic herbs in ITM

Before investigating hypnotic herbs' mechanism of action in ITM, it is necessary to know the opinions of the ITM physicians about the spirit, psychic faculty and sleep physiology. ITM introduces the heart as a source of spirit. This spirit flows in the body through the blood in the arteries. When it – known as vital spirit – reaches an organ, its temperament will change to the organ's temperament. Spirits carry three faculties: natural, vital, and psychic[9] that originate from the liver, heart, and brain respectively.[10]

Iranian traditional physicians believe that sleep occurs when heat moves towards the body interior, affects food moisture and evaporates it. When the generated vapour reaches the brain, it relaxes neural tracts or compresses them on each other and hampers the psychic faculty to reach the brain. In this perspective, the main material that causes sleep is moisture.[10] Therefore, it is believed that bodies with more moisture need more sleep and people with dry temperament need less sleep, and are more subject to insomnia.[11]

Therefore, according to the above explanation, brain dryness or warmness is the main reason for insomnia. So the principle of insomnia treatment is correction of brain temperament by wetting or cooling it. This work can be done by foods or drugs.[6] The drugs which are prescribed based on this viewpoint are those which prevent the psychic faculty from reaching the brain, and therefore induce sleep. However, hypnotic herbs use different mechanisms to prevent penetration of the psychic faculty to the brain.[12]

The hypnotic herbs which are used as inhalations for insomnia are collected in Table 1.[6-8,12,13] Some of these herbs are studied in modern medicine as well, and their hypnotic effects are confirmed. For some of these herbs, their pharmacological effects are explained in detail.

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Table 1. Hypnotic inhaled herbs in Iranian traditional medicine and comparison with modern medicine.

Common name	Scientific name	Method of administration in ITM	Pharmacological effect
Amomon	*Amomum cardamomum*[14]	Smelling[13]	Not found
Basil	*Ocimum basilicum*[15]	Smelling[13]	Insomnia, depression[16] (eugenol binding of GABA to its receptor)[17]
Belladonna (deadly nightshade)	*Atropa belladonna*[14]	Smelling[7,13]	Consumption of powdered belladonna orally has sedative-hypnotic effects,[18] sedative and antispasmodic[19]
Cabbage	*Brassica oleracea*[14]	Intranasal drop[7]	Not found
Chamomile	*Matricaria chamomilla*[15]	Intranasal oily drop[13]	Essential oil aromatherapy has been used to treat insomnia. Inhalation of the vapour of chamomile oil reduced a stress-induced increase in plasma adrenocorticotropic hormone (ACTH) levels.[20] Electrophysiological studies performed on cultured cerebellar granule cells showed that apigenin reduced GABA-activated Cl^- currents in a dose-dependent fashion.[21]
Coriander	*Coriandrum sativum*[15]	Smelling[13]	An anxiolytic, sedative and relaxant. Its mechanism of action for anxiolytic activity may be similar to that of diazepam [that acts via the gamma-aminobutyric acid $(GABA)_A$ receptor complex], as flavonoids and diazepam are structurally similar.[22]
Cucumber	*Cucumis sativus*[15]	Smelling[12]	Not found
Dill	*Anethum graveolens*[15]	Inhalation of the oil[13]	Mental disorders and inducing sleep,[23] sedative (carvone)[24]
Feverfew	*Tanacetum parthenium*[15]	Smelling[7]	Parthenium has high affinity for the $GABA_A$-benzodiazepine site. Apigenin has high affinity for the $GABA_A$-benzodiazepine site.[25] The presence of melatonin in Feverfew plant tissues may provide some explanation for the anecdotal evidence of their physiological effects in humans.[26]
Lemon Balm/ German Madwort	*Melissa officinalis*[15]	Smelling[13]	Anxiolytic effects and improvements of sleep disturbance in humans.[27] It inhibits nicotinic and muscarinic acetylcholine receptors.[28]
Harmel	*Peganum harmala*15	Smelling & plaster[13]	The alkaloids exert an inhibitory action on central dopaminergic system inducing sedation and paradoxical sleep disturbances (β-carboline alkaloids have affinity to benzodiazpines, 5-HT, dopamine receptors).[29,30]
Henbane seed	*Hyoscyamus niger*[15]	Intranasal oil drop[7]	It has sedative and antispasmodic effects (hyoscyamine, atropine, scopolamine, atroscine).[19]
Lemongrass	*Cymbopogon olivieri*[15]	Smelling blossom[13]	The essential oil of cymbopogon is effective in increasing the sleep duration in comparison with pentobarbital.[31] The anxiolytic-like effect of essential oil of one species of *Cymbopogon* mediated by the $GABA_A$ receptor-benzodiazepine complex.[32]
Lettuce	*Lactuca sativa*[14]	Smelling leaves[13]	Seed oil is found to be a useful sleeping aid in geriatric patients suffering from mild-to-moderate forms of anxiety and sleeping difficulties.[33] It has sedative and analgesic effects (non-selective μ opioid receptor antagonist).[34]
Melon	*Cucumis melo*[14]	Smelling[13]	Analgesic (triterpenoids).[35]
Myrrh	*Commiphora molmol*[14]	Smelling[7,13]	Not found
Nenuphar (European white water lily)	*Nymphaea alba*[15]	Intranasal oil drop[6]	An ethanolic extract of *N. alba* may possess anxiolytic activity. It also produces calming and sedative effects upon the nervous system, and is useful in the treatment of insomnia[36]

(*Continued*)

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Table 1. Hypnotic inhaled herbs in Iranian traditional medicine and comparison with modern medicine. (*continued*)

Common name	Scientific name	Method of administration in ITM	Pharmacological effect
Oakmoss	*Evernia prunastri*[14]	Smelling[13]	Not found
Orris root	*Iris germanica*[15]	Intranasal oil drop[13]	Not found
Poppy	*Papaver somniferum*[15]	Smelling[13]	Narcotic (opium alkaloids)[19]
Pumpkin	*Cucurbita pepo*[15]	Intranasal oil drop[7]	Antidepressant (silymarin)[37]
Safflower	*Carthamus tinctorius*[15]	Smelling[13]	Not found
Saffron	*Crocus sativus*[15]	Smelling,[12] intra-nasal oil drop[13]	Antidepressant effect[38]
Sweet violet	*Viola odorata*[15]	Smelling fresh viola and intranasal oil drop[7]	Used to treat chronic insomnia in humans.[40].The presence of melatonin in *Viola odorata* plant tissues may provide some explanation for the anecdotal evidence of its physiological effects in humans.[26]

From ITM physicians' point of view; there are three mechanisms for the effects of hypnotic plants:[12]

1. *Moisturisers*: The herbs have natural moisture or their moisturiser vapours induce moisture in the brain. Therefore, they relax neural tracts, compress them on each other and inhibit the psychic faculty from reaching the brain. Examples of these herbs are sweet violet, lettuce, pumpkin, nenuphar, cucumber, dill, melon, feverfew, cardamom.
2. *Warmers*: These herbs have little heat and it causes moisture flow in the brain. Examples of these herbs are lemongrass, orris root, sweet almond, cabbage, myrrh.
3. *Narcotics*: These herbs have much coldness and compact the psychic faculty and prevent its movement towards the brain. Examples of these herbs are poppy, henbane seed, coriander, belladonna.

Discussion

According to Table 1 we found that most herbs that are prescribed as inhalants in ITM to treat insomnia are shown to have hypnotic, sedative, anti-stress, anti-anxiety or antidepressant effects in modern medicine. Some herbs have a certain hypnotic mechanism and known pharmacologic effects but others use still unknown mechanisms. For example, there is evidence to suggest that lemongrass, feverfew, chamomile, basil, coriander would affect GABA receptors; sedative effects in harmel relates to 5-HT and dopamine receptors; and madwort (lemon balm) improves sleep disturbance by inhibiting nicotinic and muscarinic acetylcholine receptors.

We found that there are three different mechanisms for hypnotic effects in medicinal herbs considered by ITM physicians: moisturisers; warmers and narcotics. Though we can not match the traditional mechanisms with modern pharmacological effects, it can be said that these plants can be used as adjunctive drugs in insomnia treatment.

Finally, we suggest more investigations on herbs which are recommended in ITM, but have missing information about their effects in treatment of insomnia in today's medicine.

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Extemporaneous Preparations from the Past

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Compounding involves the preparation, packaging and labelling of a drug specifically for a particular patient according to a medical prescription.[1]

Until the mid-1900s, the compounding of such 'on-demand' pharmaceutical preparations, also known as extemporaneous preparations, was the basis of pharmacy. In Italy, in 1580, descriptive catalogues and standards for quality and uniformity of pharmacy formulas for pharmaceutical preparations were compiled. These became known as the 'pharmacopoeia'.[1] In the 1930s and 1940s, about 60% of all drugs were compounded. However, in the 1960s, manual preparation declined.[2]

The objectives of the study were to demonstrate different methods of preparations of various drug formulations irrespective of the active ingredients used and to compile a list of extemporaneous preparations that were compounded between the years 1955 to 1965.

Methodology

Dosage forms, including liniments, ointments, suppositories, mixtures, creams and sachets and their corresponding ingredients were identified and the necessary active ingredients according to the *British Pharmaceutical Codex 1934*,[3] apparatus and materials were obtained. Preparatory sessions, were attended to, in which with the help of a pharmacy compounder with experience in the preparation of the identified products, the compounding of the selected dosage forms was practised. The re-enactment activities were promoted at the University of the Third Age (U3A). The re-enactment activities were further promoted through an advert on a health professionals portal Facebook page and eNews and published in one issue of the printed journal of the same entity. A leaflet and a questionnaire in English were formulated, validated and checked for grammatical mistakes. The aim of the questionnaire was to evaluate the quality of the re-enactment activities and the leaflet given to each participant. The test-retest method was used to test the questionnaire's reliability where 10 lay persons completed the questionnaire twice with a 2=week interval.

Re-enactment activities, in which 220 participants attended, were organised at *Aula Magna* Valletta during the Annual Pharmacy Symposium 2012 Campus, *Santo Spirito Hospital* in Rabat, and Department of Pharmacy at University of Malta. Participants came from secondary schools and the University of the Third Age.

A list of extemporaneous prearations was compiled using Microsoft Excel. The 1955-1965s timeframe was chosen and extemporaneous preparations were obtained from Pharmacy Drug registers found at the former *Santo Spirito Hospital* in Rabat, Malta. The Excel sheet formed consisted of 5 columns;

A. Number – each extemporaneous preparation was noted with a number.
B. Medicament – the extemporaneous preparation name.
C. Ingredients – all the ingredients used, active ingredients followed by inert ingredients, to produce such an extemporaneous preparation.
D. Use – the indication and/or the properties of the extemporaneous preparation where applicable.
E. Dosage form – drug formulation of the extemporaneous preparation.

Results

The 11 re-enactments activities were attended by 65 males and 155 females, none of whom had a medical profession.

A total of 192 complete questionnaires were collected, resulting in a response rate of 87.3%. The presentation was graded from 1 to 5, with 1 being the least satisfactory and 5 being the most satisfactory; none was graded least

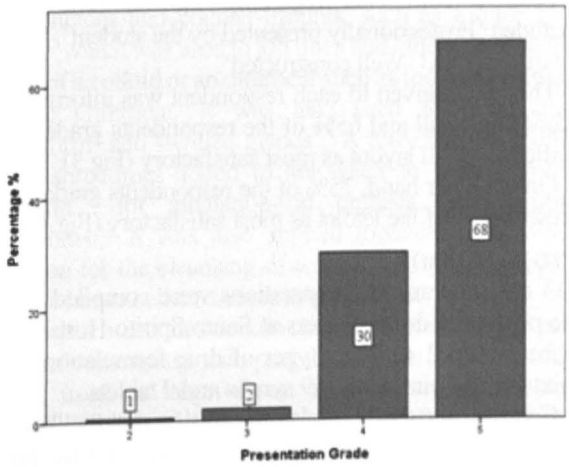

Figure 1: Grade of presentation (n=192).

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satisfactory and 68% graded the presentation as most satisfactory.

Only 19 respondents thought that the activity was either short or long (Table 1).

Table 1: Timing of the Presentation (n=192).

Time	Frequency	Percentage
Short	10	5.2
Satisfactory	173	90.1
Long	9	4.7
Total	192	100

16 of the 192 participants did not agree with the location chosen, the main reason being it was a small place.

Three-quarters of the respondents thought there was no room and need for improvement. However 25% thought that the sound, leaflet provided and the demonstration display needed to be improved.

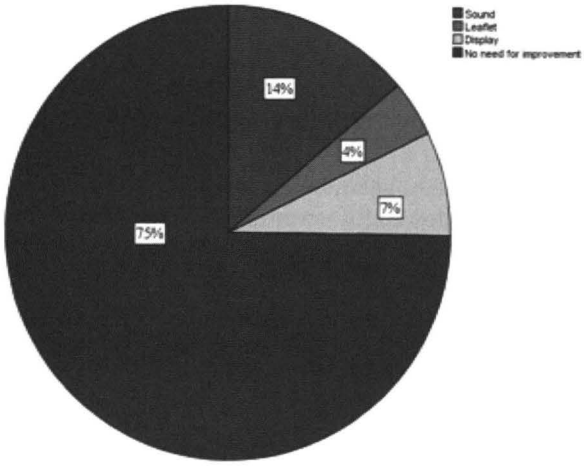

Figure 2: Any Need for Improvement? (n=192).

Only 2 of the 192 respondents thought that the activity was not worth the time and effort of the student organising it.

Positive comments regarding the demonstrations included 'Professionally presented by the student', 'Very interesting' and 'Well constructed'.

The leaflet given to each respondent was informative according to all and 65% of the respondents graded the leaflet's overall layout as most satisfactory (Fig.3).

On the other hand, 75% of the respondents graded the presentation of the leaflet as most satisfactory (Fig.4).

Preparations

133 extemporaneous preparations were compiled from the pharmacy drug registers at Santo Spirito Hospital in Rabat, with 31 different types of drug formulations: 22 mixtures; 18 ointments; 19 syrups and 9 tablets.

Capsule, ear drop, emulsion, infusion, linctus, liquor, paint and suspension were the dosage forms least encountered during the compilation of the extemporaneous preparations.

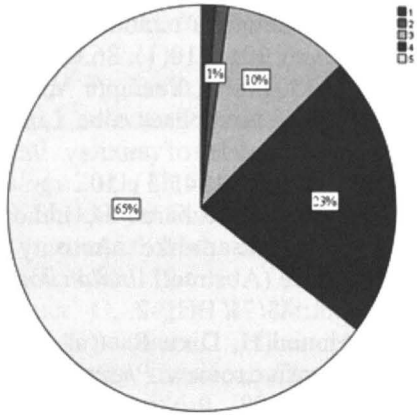

Figure 3: Grade of Leaflet's General Layout (n=192)

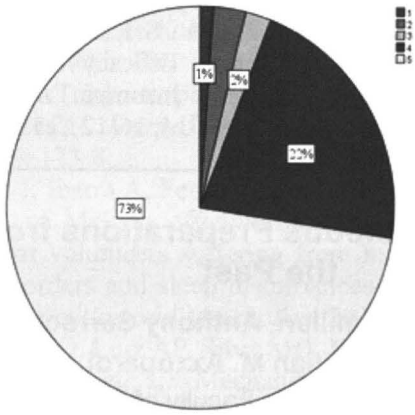

Figure 4: Grade of Leaflet's Presentation (n=192).

Discussion

It may be impossible to determine exactly when human beings first began to mix substances and compounded preparations that they perceived to exert a therapeutic effect on administration. However, the compounding of medicinal products of materia medica of plants and animals was practised since ancient times.[4]

Ancient Egyptians, Greeks, Romans, and Arabs all developed medical knowledge resulting in the integration of various aspects of pharmacy and compounding.[4]

Medicines were concocted with a mixture of empiricism and prayer. Trial and error, inherited lore and mystical theories were the basis of pharmacopoeias. In the 1960s, the technology of making drugs was crude at best; medicaments were mainly of herbal origin.[5] They were generally made with water or alcohol-based extracts of freshly ground or dried herbs or animal products.

The re-enactments, which were targeted to all age groups, were all well attended and proved to be fruitful, as tremendous interest shown by both the secondary students and the third age students was evident. Eager secondary students were allowed to participate in the compounding of the chosen extemporaneous preparations where they weighed the active ingredients using the the weighing balances, hence gaining first-hand experience, especially for those who had not yet attended

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Table 2: Section from the Compiled List of Extemporaneous Preparations (n=133)

Number	Medicament	Ingredients	Use	Dosage Form
1	Canellae	Cinnamon distillate	Antipyretic, tonic	Solution
2	Acriflavine glycerin	Acriflavine, glycerin	Disinfectant, reduce swelling	Solution
3	Compound Tincture of Rhubarb	Rhei, Simple Syrup (1 part sugar and 2 parts water), Cardamom	Flatulent colic, dyspepsia, constipation.	Mixture
4	Mistura Potassium Citrate	Pottasium citrate, citric acid, syrupus aurantis, Aqua Chloroform	Cystitis – decreasing urine acidity	Mixture
5	Hamech	Thyme, anise, ginger, absinthe, scammony	Venereal disease	Mixture
6	Diacatholicon	Cassia, tamarind, rhubarb, violets, aniseed, sugar.	Analgesic – pain relief	Syrup
7	Jera	Aloe, spikenard, honey, mastic, agaric	Blood purifier	Syrup
8	Senna Aromaticus	Senna, jalap, rhubarb, aromatics	Constipation	Syrup
9	Galbanum pill[5]	Asafetida, galbanum, myrrh	Digestion problems, flatulence, poor appetite, cough, spasms.	Pill
10	Foetidae Pillulae	Turpeth, sagapenumand, myrrh	Constipation, stomach ache, cough	Pill

any chemistry practicals. This enhanced the need for appreciation of the way pharmacists had to compound drugs accurately and in a meticulous way.

What was of much concern was the fact that the interest shown was not by pharmacists or by people with a medical profession but by laypersons. Hence healthcare professionals do not show much interest in the way medicines were compounded in the past and do not appreciate much how the pharmacy profession evolved through the years. This was evident from the number of demonstrations organised since the publication of the advert in the healthcare professionals journal. One may argue that healthcare professionals have a hectic lifestyle and were not able to attend these activities although the activities were relatively short. Some Third Age students showed so much interest that they even asked whether they could attend the next re-enactment activites in order to recall the older ways of compounding in their younger times.

Dosage forms chosen to be compounded during the re-enactment activities, including creams, sachets, mixtures and ointments, are still compounded nowadays in a clinical or community setting hence making the study beneficial by advancing the pharmacist position in today's society. On the other hand, these demonstrations should also pave the way to indulge in the many obsolete or near obsolete extemporaneous preparations that were compounded long ago by pharmacists.

After compilation of the list of extemporaneous preparations, it was evident that a vast range of drug formulations existed in the past. However, apart from this, the need to discuss certain important ingredients considered to be essential for human health is of importance, since some ingredients tend to be found in more than one extemporaneous preparation. Some imparted more than one therapeutic property and hence were indicated for several conditions. Among others, the following ingredients were of utmost importance.

Boric acid was administered in the form of cachets, pastilles and orange-flavoured mixtures[6] to sooth irritation and as hot applications for the treatment of boils, carbuncles, ulcers and whitlows, hence imparting its antiseptic property by being bacteriostatic.[7]

Iodine was administered in the form of a liquor for the treatment of chronic rheumatism, hypothyroidism and for preparation for surgery in hyperthyroidism.[8] Iodine was also present in preparations applied externally as parasiticides and counter-irritants, such as Liquor Iodi Fortis[7] which was used to kill tinea and other fungi. In the form of a colloid or an ointment such as the Non-staining Iodine Ointment. It was also used for chilblains, ringworm[9] and swollen glands .[7] A few drops of iodine were sometimes added to hot water to form a weak solution for inhalation in phthisis and chronic bronchitis.[10] It was also applied topically as a weak solution for the cleansing of wounds[11] to prevent sepsis since it has excellent antiseptic properties.

Rhubarb contains certain anthraquinone derivatives[12] as chief constituents with purgative properties, especially when used in large doses. A purgative effect was generally followed by an astringent effect from the tannin constituent. Hence, rhubarb preparations were employed as occasional aperients but not in chronic constipation. It

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was also employed in diarrhoea[7] and as a stomachic in dyspepsia and as a laxative.[13]

This study can pave way to further research to disseminate knowledge on traditional formulations used in pharmacy and also to identify most prominent ingredients preferred by prescribers at the time for the preparation of extemporaneous preparations. Trends in changes in the use of ingredients throughout the years could be identified.

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The Anglo-American Pharmaceutical Company Limited

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While researching British pharmacy for the period around World War I, I came across an advert in the *Chemist and Druggist Diary* for a pharmaceutical manufacturing company that I didn't know. The company was the Anglo-American Pharmaceutical Company Limited of Croydon; it offered a list of interesting products and had won gold medals at London, Bombay, Buenos Aires and Sao Paulo, Fig 1.[1]

The founder of the company was Mr Hubert Huxley Mason, Fig 2.[2] He came from a family of chemists going back to Aaron Huxley, his grandfather, 'a distinguished practitioner of the art and science of his day,' who pioneered bone phosphate manufacture at Newport (Shropshire) in 1850. Mr Hubert Huxley Mason passed his Minor examination in 1883[3] and soon after opened a pharmacy at Parsons Green, London. SW.[4] He formed a company in 1892 with his brother. In 1898 Mr Hubert Huxley Mason ventured into the wholesale manufacture of medical preparations, notably those of the glycerol-phosphate type, and introduced Huxley's Syrup

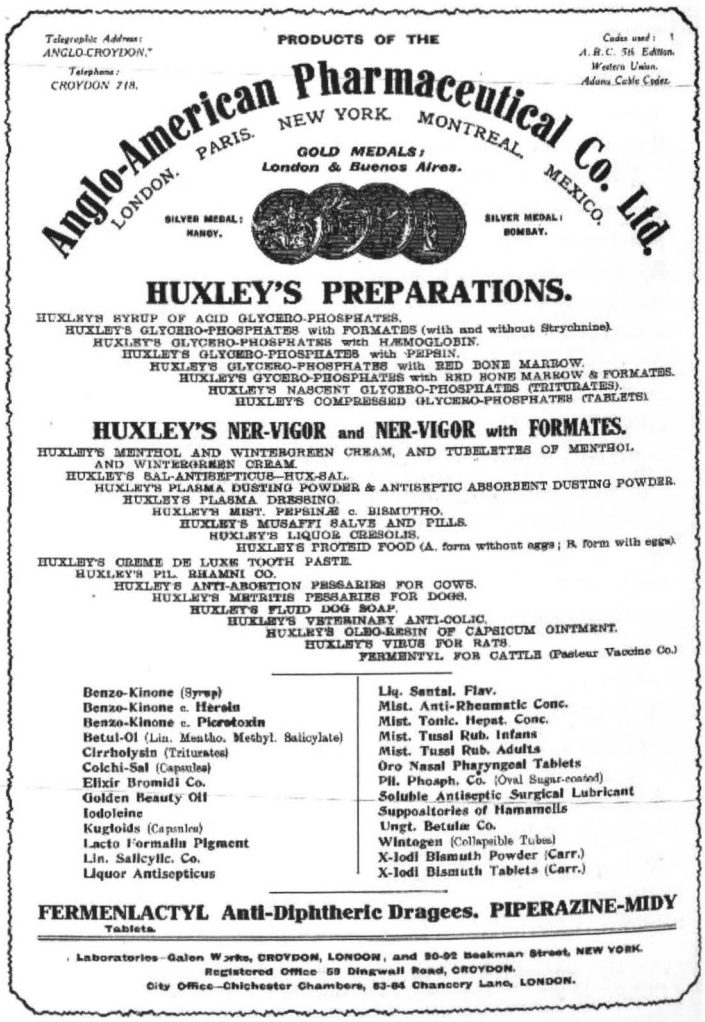

Figure 1. Advertisement for Anglo-American Pharmaceutical Co. Ltd, 1911.[1]

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(glycerole) of the acid glycerol-phosphate. The product was 'a bright, clear, non-depositing, non-fermenting,

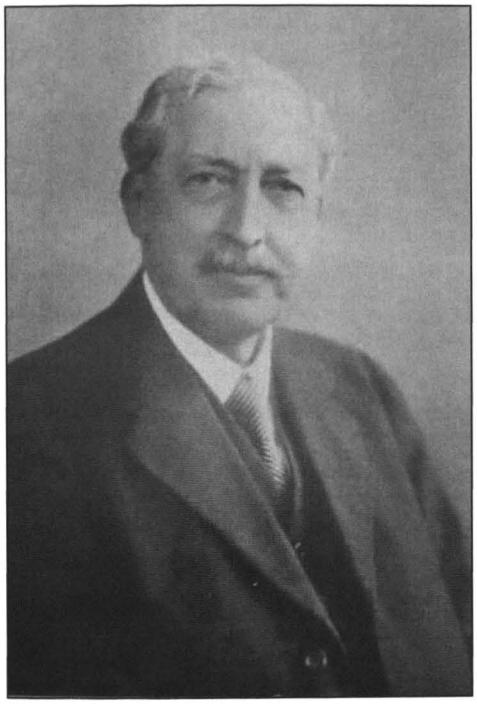

Figure 2. Hubert Huxley Mason, 1931.[2]

sugar-free glycerole'.[2] From 1892 to 1901 Mr Hubert Huxley Mason lived in West Brighton, then West Norwood, London SE , then Purley, Surrey and at 45 Kidderminster Road, West Croydon in 1902.[3] The Croydon Directory[4] for 1904 and 1905[5] listed H Huxley Mason as wholesale chemist with premises at 3 & 5 Frith Road, Croydon. In the 1906 Croydon Directory,[6] the business at 3&5 Frith Road, Croydon was called the Anglo-American Pharmaceutical Company Limited,[2] incorporated as a limited company in 1906. The *Chemist & Druggis*[7] detailed the new company:[7]

> 'whose objects were to take over the business of chemists, druggists, perfumers, manufacturers of and dealers in toilet-preparations etc carried on by H.H. Mason, in some respects under the name of the 'Anglo-American Pharmaceutical Co' and in other respects under the name of the 'Huxley Pharmaceutical Co at 3 and 5 Frith Road, Croydon, Surrey, and in New York, Montreal, and other places including a portion of the assets thereof, but not the right to sell in France, Belgium, Spain, Portugal, Italy, Roumania, Switzerland, Turkey, Columbia, Cuba, Venezuela, Brazil, Ecuador, Peru, Chili, Uruguay, Mexico, Guatemala, Honduras, Salvador, Costa Rica, Nicaragua, Argentina, Bolivia, Paraguay, and Panama, and the respective Colonies thereof, the preparations known as "Colchi-Sal", "Betul-Ol" and "Antipaludic".'

The first subscribers were listed and HH Mason was the chairman and managing director with remuneration of £300 per annum. The business progressed and exhibited two new products, 'Huxley's syrup of acid glycerol-phosphates with formates' and 'benzo-kinone with heroin' (a guaiacol derivative for cough), at the Royal Horticultural Society's Hall, Westminster for a week in October 1906.[8]

In 1907 at another exhibition, at the Royal Horticultural Hall, the Anglo-American Pharmaceutical Co Ltd promoted a new lactic ferment made by the Pasteur Vaccine Co of Paris. This ferment was said to be antagonistic to the germ that caused auto-intoxication and was of peculiar value in infant feeding. The product was in tablet form and one tablet was added to milk at a certain temperature. It was specially recommended in cases of infantile diarrhoea.[9] Another product, a Menthol and Wintergreen Cream known as 'Tubelette,' was advertised in the *Chemist & Druggist* 1908 trade notes.[10] The price was protected under the Proprietary Articles Trade Association (PATA) scheme. The scheme was championed by William Samuel Glyn Jones, a proprietor pharmacist, in 1896 against price-cutting on proprietary medicines.[11]

In March 1909 the company opened a city office and showroom on the ground floor of Chichester Chambers, Chichester Rents, Chancery Lane. London, where 'they would receive inquiries and execute small urgent orders'.[12]

In 1909 in Bombay, the company exhibited 'Huxley's Syrup Ner-Vigor', promoted for diabetes and neurasthenia, and other special pharmaceutical preparations including compressed tablets representing, in small bulk, the active constituents of Huxley's Syrup. In addition their Crème-de-Luxe toothpaste received considerable attention.[13] In the same year the *Chemist & Druggist* reported:

> an outbreak of fire in the early morning of July 21st on the premises of the Anglo-American Pharmaceutical Co, Ltd at 3 & 5 Frith Road, Croydon. A timber and corrugated-iron building in the rear, which was stored with drugs and chemicals and contained valuable machinery, was totally destroyed, while the shop and warehouse fronting the road, was also gutted. The total damage was estimated to be £1,500.[14]

Despite the fire the business continued and on October 9th 1909 the company exhibited in the Royal Horticultural Hall at a medical exhibition organised by the *British and Colonial Druggist* on the theme 'Aesculapius and the disciples of Galen'.[15] The Croydon Directory of 1910 showed that the Anglo-American Pharmaceutical Co, Ltd had moved to 59 Dingwall Road, Croydon.[16] There was further very interesting coverage in the *Chemist and Druggist* Supplement of July 30th 1910.

An injunction in the *Chemist and Druggist* Supplement of July 30th 1910[17] informed the reader that

> in the Chancery Division on July 28th 1910, Mr Justice Swinfen-Eady heard a motion in an action brought by Mrs Eliza Jane Chapman against Mr Hubert Huxley Mason trading as the Anglo-American Pharmaceutical Co and the Liniline Co Ltd for an injunction to restrain the first defendant permitting certain premises at Croydon to be occupied by the Liniline Co or any other person or company carrying on the business of linen water-proofers or other dangerous business which rendered premises uninsurable against fire. An injunction was also asked against the Liniline Co to restrain them from carrying on the business of linen waterproofers or other dangerous business. Mr Macnaghten KC and Mr G B Hamilton appeared for the plaintiff, Mr Paterson for Mr Mason and Mr H F F

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Greenland for the Liniline Co. His Lordship granted the injunction until judgement in the action or further order.'

The company continued to exhibit their products and in the Great Hall of London University, London on July 30th 1910 the main exhibit was Huxley's Syrup of Glycerophoshates in various combinations; also exhibited was Huxley's Protein Food, a 50% mixture of assimilated proteins from milk and egg made using an active lactic ferment called Fermenlacyl obtained from the Pasteur Vaccine Co.[18]

There was reduced information about the company and its products in the *Chemist and Druggist* in the years leading up to the First World War. A quotation from *Veterinary News* Jan 2nd 1915 promoted the 'professionalism of the veterinary products and their packaging as made by the Anglo-American Pharmaceutical Co Ltd at that time.' This quote is found in a promotional price list produced in 1934.[19] The *Chemist and Druggist* trade news in 1915 reported that drug shortages meant 'the advance in the cost of raw wholesale price of Huxley's Syrup of acid glycerophosphates'. The new prices were given in the company's advertisements.[20]

With war regulations relaxed in 1919, the Anglo-American Pharmaceutical Co. Ltd advertised 'The Company now can supply proprietary articles held up due to the war'.[21] In July of that year Huxley's glycerophosphate syrups, Sap-Lauand, Zita Baking Powder and Huxley's Vanishing Cream were exhibited at a Chemists Exhibition in London.[22] They also exhibited Sal Antisepticus, a nasal douche product for cold symptoms,[23] and Tubelette at an exhibition in 1919.[24]

The Miscellaneous section of the *Chemist and Druggist* for August 16th 1919 reported 'A Mysterious Window Fracture in the factory of the Anglo-American Pharmaceutical Co Ltd, Dingwall Road, East Croydon.' A bullet was believed to be the cause of the broken window but as a number of packing cases were stored close to the window, a missile could not be found. Windows in this factory had been broken in a similar manner on five occasions a few years before. A reward was offered for information which would lead to a conviction for the damage.[25]

At another medical exhibition in October 1919 in London the company had a large stand fitted with their products. A centre stand was given over to Huxley's glycerophospate syrups with formates, red bone-marrow etc. Elsewhere on the stand was Sal Antisepticus, Zita dusting powder and Tubelette of menthol and wintergreen cream.[26] The *Chemist and Druggist* in March 1920 referred to the recent price changes in the price of menthol and wintergreen Tubelettes which had increased from 3s to 3s 6d.[27]

Huxley's Witch Hazel Toilet Jelly was promoted in the *Chemist and Druggist* trade novelties in June 1925 as a jelly for midge bites, packed in collapsible tubes and yellow and brown cartons, figure 3.[28] A neatly lettered show-card was available for advertising purposes and further promotion of this product in the *Chemist and*

Figure 3. Carton for Huxley's Witch Hazel Toilet Jelly.[28]

Druggist in July 1927 offered 'to send to fifty lady customers of a chemist, free packages of Huxley's Witch Hazel Jelly, with chemist's name and address and other literature in the package.'[29] The *Chemist and Druggist* in 1932 carried details of the sole agent for Scotland, Mr A Duncan Mason of 30 Marlborough Road, Cathcart, Glasgow[30] and listed Mr Curtis Marshall, a son of Mr GM Marshall, as representative for the company in Northern Ireland.[33]

In April 1932 the *Chemist and Druggist* new companies section listed

> The Anglo-American Pharmaceutical Co Ltd. (P.C) - capital £10,000. Objects: to acquire the business now carried on by the Anglo-American Pharmaceutical Co Ltd (in liquidation) and all or any of the assets and liabilities, and in particular the formulae and full information as to the process of manufacturing and the right to manufacture and deal in certain medicinal preparations, and to carry on the business of manufacturers and sellers of medicines and preparations, chemists, druggists, drysalters etc. R.O.; 59 Dingwall Road, Croydon, Surrey.[31]

The *Chemist and Druggist* Trade notes in May 1932 advertised a new product named Sprai.[32]. It was a liquid fly killer of British manufacture. The outfit comprised a tin of Sprai which screwed on to a pump which readied the apparatus for use. When the tin was empty a new tin was screwed on in place of the old. The preparation was stated to be stainless and pleasantly perfumed. Apart from advertising in the national press, use was to be made of the cinema (talkie) for publicity purposes and particulars of the special offers which were being made to chemists were found in adverts in the same *Chemist and Druggist*.

The *Chemist and Druggist* for July 2nd 1932 carried the obituary of Mr Hubert Huxley Mason, who died at Addiscombe, Croydon aged 71 years.[34] The wording of the obituary was identical to the report of him in 'Who's Who in the Drug and Allied Trades' published in 1931 and given in reference 2.

The company continued to display new products. At the London Medical Exhibition at the Royal Horticultural Society in October 1932, an interesting novelty was Casali-Alpha. This tonic was devised by Professor P Casali 'to postpone the onset of arteriosclerosis without increasing blood pressure and thus represented a distinct advance in the treatment of conditions associated with asthenia'. The Anglo-American Pharmaceutical Co Ltd had taken an agency for this product and Huxley branded products were also displayed.[35]

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At the September 1933 Chemist Exhibition at New Hall, Royal Horticultural Society, London, the company introduced 'Dermafoam' an oil soluble emulsion which facilitated the extraction of embedded dirty deposits in skin crevices. Also exhibited was Casali-Alpha, the 'elixir of life' according to the press of the day.[36]

In October 1933, the *Chemist and Druggist* Trade notes reported that Mr H Chase Mason, son of the late Mr

Figure 4. Advertisement for Casali-Alpha.[42]

Hubert Huxley Mason of 9 Greencourt Gardens, East Croydon, was solely engaged in the marketing of Stomo-Tab, an anti-dyspeptic tablet.[37] Another exhibition was reported in the *Chemist and Druggist* in October.[38]

The 24th London Medical Exhibition in October 1934 promoted Sal-Antisepticus, Huxley's Syrup Glycero-phosphate Co, Pil Rhamni Co, a surgical powder, Casali-Alpha and Dermafoam, recommended for use after handling the motor car.[39] In December Mr Thomas H Davidson had joined the company as a representative to assist Mr A Duncan Mason in Edinburgh and East of Scotland.[40] The Chemists Exhibition in September 1938 featured the Anglo-American Pharmaceutical Co. Ltd who promoted Huxley's Wintogeno, Sal Antisepticus, Dermofoam, Renula tablets and Menthol and Wintergreen Cream.[41]

During the Second World War (1939-1945), there was no information in the *Chemist and Druggist* on the Anglo-American Pharmaceutical Co Ltd. After the war, adverts for Huxley's products Ner-Vigor and Huxley's Wintogeno Cream appeared in the *Chemist and Druggist Year Book 1945* (see Figure 4).[42] In May1946 Mr A Cordes, MPS joined the company as production manager on his release from the Directorate of Medical Supplies.[43]

The *Chemist and Druggist* in 1949 stated that the Anglo-American Pharmaceutical Co Ltd of 59 Dingwall Road, Croydon had 'ample supply of Piperazine Midy' and had resumed their agency for the product.[44] Though the *Chemist and Druggist Year Book 1950* had an advert for Huxley's Ner-Vigor and Wintogeno cream this was their last mention of the Anglo-American Pharmaceutical Co Ltd.[45]

Sanger's List

Another useful source of information on proprietary medicines was the *Sanger's List*, produced by the wholesaler Sanger's. The *Sanger's List* for 1951-1952[46] listed Huxley's Antiseptic Dusting Powder, Pil Rhamni Comp and Sal Antisepticus; this was a small range of Huxley's products compared to the *Sanger's List* for 1910 which displayed about thirty items.[47] The *List* of 1962[48] showed the range of Huxley's Preparations had increased to five, with several product sizes, making a range of ten items.

In the 1965 *Sanger's List*[49] only one product, namely Huxley's Dusting Powder, was listed and the manufacturer of this Huxley's product was a company called Gale Baiss and Co Ltd. The company was based in Slough and advertised in the *Chemist and Druggist Year Book* of 1963 as Pharmaceutical Manufacturers.[50]

The Anglo-American Pharmaceutical Co Ltd of Dingwall Road, Croydon therefore was no longer manufacturing its own products after 1965 and Huxley's Dusting Powder was absent from the *Sanger's List* of 1966. There were factors after the Second World War which may have influenced the company's future.

The Anglo-American Pharmaceutical Co Ltd which had been a registered pharmaceutical premises from 1937-1947 at 59 Dingwall Road Croydon[51] stopped being a registered premises after 1947. The Anglo-American Pharmaceutical Co Ltd was still listed in the *Croydon Directory* until 1956 though as chemist suppliers and manufacturers.[52] Croydon and Dingwall Road had suffered much damage due to bombing in the Second World War;[53] although Number 59 was not damaged most of the street was. Croydon then underwent a massive rebuilding program and today Dingwall Road is a modern tower-block dominated road with no evidence of where no 59 was.[54]

The Huxley brand was manufactured by the Anglo-American Pharmaceutical Co Ltd up until at least 1962. I have not found a date when the Anglo-American Pharmaceutical Co Ltd ceased to trade nor any information on the internet for the dissolution of the company.

The Anglo-American Pharmaceutical Co Ltd seemed to have gradually faded away. Market forces, the effects of the Second World War bombings or changes due to the newly formed NHS in 1948, may all have played a role in the decline of this pharmaceutical company.

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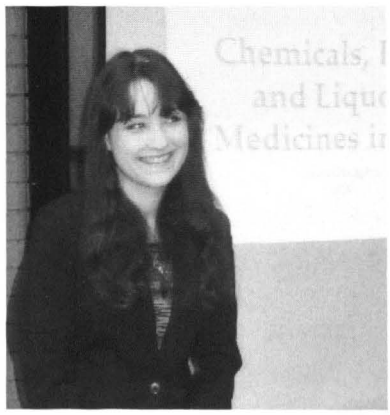
BSHP Annual Spring Conference March 2015 at Roker Hotel, Sunderland



Pharmacy student Laura Ghiggino giving the Burnby Award Lecture 2015

BSHP president Briony Hudson presenting a Lesley Matthews Medal to secretary Peter Homan. A Medal was also awarded to Dr John K Crellin, who was the first secretary of BSHP.

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British Society for the History of Pharmacy
Q House, Troon Way Business Centre, Humberstone Lane,
Thurmaston, LEICESTER LE4 9HA

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British Society for the History of Pharmacy

Q House,Troon Way Business Centre, Humberstone Lane, Thurmaston, Leicester, LE4 9HA
Tel: 0116 274 7355, Fax: 0116 274 7365, Email: bshp@associactionhq.org.uk Website: www.bshp.org

The British Society for the History of Pharmacy was formed in 1967 under the aegis of the Pharmaceutical Society of Great Britain, having originated from its History of Pharmacy Committee.

BSHP seeks to act as a focus for the development of all areas of the history of Pharmacy, from the works of the ancient apothecary to today's ever changing role of the community, hospital, wholesale or industrial pharmacist. Membership is open to all interested in the aims of BSHP.

Aims

Promotion of historical studies related to pharmacy.
Advancement of knowledge and propagation of understanding of the history of pharmacy.
Publication of the research work of pharmaceutical historians.
Preservation of pharmaceutical artefacts and historic pharmacies.
Support for the work of relevant museums and offering advice on establishment of other pharmaceutical exhibits and on the preservation of pharmacies.
Co-operation with related professions and local historians on medico-pharmaceutical topics of mutual interest.

Pharmaceutical Historian

The *Pharmaceutical Historian* has been published since 1967, at first intermittently, but on a regular quarterly basis from 1972. Issues generally comprise 16 or 20 pages and cover.

An **index** for the years 1967-1995 was published in 1998, for 1996-2000 in 2000, for 2001-2005 in December 2005 and for 2006-2010 in December 2010. They can be viewed on the website.

Papers, short communications and letters in English on any aspect of the history of pharmacy are welcome and should be sent, preferably as an email attachment to *ainley.wade@easynet.co.uk* or to the address above. Any illustrations are converted to monochrome for printing. Further details of requirements can be found on the website *www.bshp.org* under Publications.

Membership

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Four issues of the *Pharmaceutical Historian*.

Regular meetings, with guest speakers, usually in November, February and May.

Visits to places of historic interest, museums, collections, botanical gardens, etc.

Annual Conference, usually in March/April.

Free use of the Royal Pharmaceutical Society of Great Britain's library facilities for research.

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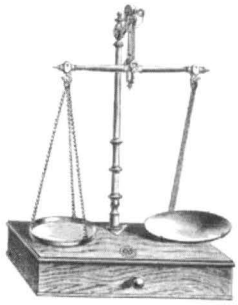

PHARMACEUTICAL HISTORIAN

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Contents

Diary

Please note that unless otherwise stated, the evening meetings will be held at the new RPS headquarters, 66-68 East Smithfield, London E1W 1AW, starting with refreshments at 5.00 pm.

Monday 12 October 2015
'Joseph Banks' by Andrew Sankey. At new RPS headquarters at 66-68 East Smithfield, London E1W 1AW, 5.00 for 5.30.

November 2015
Joint Meeting with Medway School of Pharmacy. Details to be confirmed.

Future dates 2016 (all to be confirmed)
Monday 8th February
Monday 9th May
Monday 10th October

BSHP Annual Spring Conference 1-3 April 2016
To be held at Reading, Berkshire on the theme of 'Education'.

BSHP Officers 2015-6
The Committee elected the following Officers at its July meeting:
President, Roy Allcorn; Vice President, Peter Homan; Honorary Secretary, Peter Homan; Treasurer, Deborah Bishop.

Chemicals, Herbs and Liquors: Medicines in 1914

Laura Ghiggino
3rd Year MPharm Student, University of East Anglia, Norwich

One hundred years ago the landscape of medicine and hospitals was almost unrecognisable compared with today. The NHS did not exist, nor did antibiotics or many synthetically made medicines. The research is based on 'The London' Hospital in Whitechapel which was one of the most advanced hospitals of the time and offered free healthcare to the poor who were abundant in the area. Its complete and extensive records from the pharmacy and hospital have been used to understand what drugs were available, what were the most common conditions and how they treated them and to a lesser extent how did they compare with modern medicine.

Overview and issues with the research

The records used were the *The London Hospital Pharmacopeia 1914* and an update insert, the index of admitted patients, the pharmacy log book and a number of patient files (all male). There were some errors in the records, especially the index: it was noticed when looking up patient files that the condition on the index did not always match the condition on the file. This only occurred once; however, it would affect the statistics. Some conditions were not documented and a number of patients had no notes or their illnesses were not recorded. This only affects the prevalence of conditions at the time. The London did have patients of different levels of wealth, but the majority were poor; this skews the types of conditions at the time and comparison study with hospitals from rural and/or wealthy areas would be favourable. The medicines themselves would not have been affected by the location of the hospital, however; other resources would most likely have been used alongside the resources accessed.

The London Hospital Pharmacopeia[1]

Whilst the pharmacopeia looked extremely small, it took a long time to copy out and research, partly because there were many remedies but also because they were all in Latin. The majority of drugs listed were chemicals (such as ether, silver nitrate or prussic acid), drugs isolated from plants (morphine, codeine or quinine) or whole herbs or plants (digitalis leaf, belladonna extract, ipecacuanha).

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There was a wide range of formulations, such as powders, elixirs, suppositories, subcutaneous and intravenous injections, inhalation powders, syrups, treated plasters, liquors, extracts, oils, liniments, lotions, enemas, infusions, ointments, creams, poultices, liquid mixtures called mistura and tablets (tabellae). Most medicines came in multiple formulations such as atropine injection, atropine lamellae (eye disks) and belladonna tincture. Some of the medicines are no longer used[2] due to the fact that they are highly poisonous such as mercury (for diarrhoea), strychnine (for the emergency stage of pneumonia)[3] and hemlock (sedative).

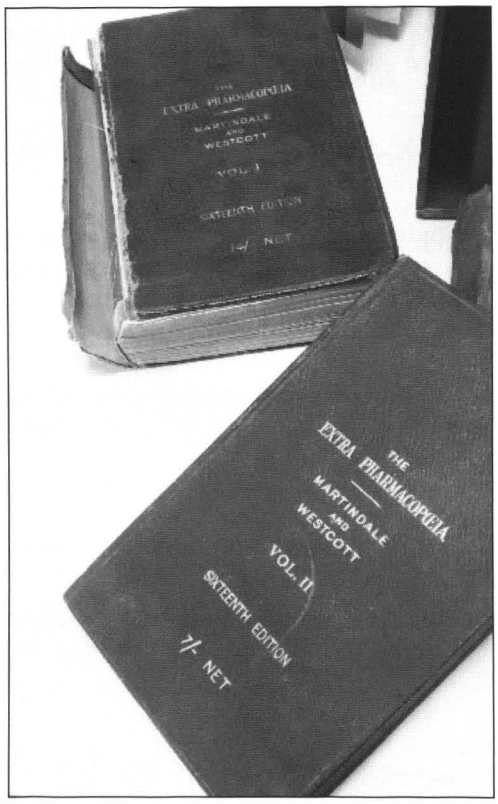

Figure 1. An example of a Pharmacopeia used in 1914: Martindale and Westcott. *The Extra Pharmacopoeia,* 16th edn, vols 1 and 2. (*Not* the London Hospital 1914 Pharmacopeia) Used with permission from the University of East Anglia.

Infection without antibiotics

In 1914 there were no antibiotics available. Penicillin was of course not discovered until 1928 and the sulphanilamides in 1935,[4] and there were not many vaccines available, only smallpox, rabies, tetanus, cholera and typhoid. Infection was controlled mainly by cleaning with antiseptic liquids such as carbolic acid (phenols), potassium permanganate and hydrogen peroxide, which are all still used today.[5] Perchloride of mercury was often used to disinfect homes where someone had suffered from an infectious illness.[6] Childhood illnesses killed many children, most of which are rare now or easy to cure. Measles, mumps, rubella, whooping cough, diphtheria and scarlet fever were common and with the exception of diphtheria not hospitalised by the London as there were fever isolation hospitals which had special ambulance services to try to prevent spread in the population. In 1914 scarlet fever cases increased as did deaths from 1913;[7] there were 16 cases and 1 death at the London hospital.[8] Simple gastroenteritis, known as D and V [diarrhoea and vomiting], was one of the biggest killers; it especially killed in the summer months and often in clusters of admissions. It wasn't until the 1920s that simple saline and sugar infusions that kept children alive was administered. One attempt at curing D & V in 1914 was shown in the case of a 4-month-old baby admitted 26th September 1914. He was given milk, barley water and lime water in an attempt to keep up fluids and minerals, an enema, and mercury with chalk. He survived and was discharged on the 22nd October 1914.[9] According to the 1914 index of admissions there was a total of 224 cases of enteritis, with a 50% death rate. There were 297 enteritis deaths in 1914 in the district of Stepney where the London hospital was situated.[7]

In terms of other deaths due to infection, pneumonia, TB and TB-related infection such as TB meningitis were in the majority. Cases and deaths can be seen in Figure 2 (p. 55). Pneumonia and other respiratory infections killed 929 people in the Stepney district,[7] including approximately 184 deaths at the London hospital.[8] In such cases, brandy was often used as a stimulant and magnesium sulphate as a laxative. Prussic acid, present in cherry water, was mentioned in the pharmacopoeia and was discovered to have been used for TB and pneumonia;[10] there was no mention of prussic acid being used in the case files but the prescribing of this medicine was in decline by 1914. Syrup of squill was also regularly used in respiratory cases due to its expectorant qualities.[2] Morphine was used in a number of different formulations including, injection, liquor and linctus. Morphine, like its predecessor opium (which was also used at the time), was administered for pain relief and sometimes coughs.

The Heart

Digitalis was used to correct heart arrhythmias, similarly to digoxin use today.[2] Interestingly, emphasis on heart medication has been a more modern development. Aspirin had only just been introduced in 1914, in fact it is mentioned on an insert of new drugs halfway through the year. According to one worrying case, aspirin was used to treat a haemophiliac with internal bleeding, but fortunately the patient survived[11]. It seems a fuller understanding of the effects of aspirin had yet to take hold. Adrenaline was used in heart failure and caffeine used as a stimulant as well as many types of alcohol. In 2013 the most prescribed NHS drug was simvastatin[12] and others in the top 10 included prophylactic medications for heart conditions. Heart medication in 1914 was reasonably basic with a poor success rate. There has been a shift in the last 100 years from solely treating maladies to trying to prevent them from happening in the first place.

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Cancer – a losing battle

There were fewer cases of the majority of cancers in comparison to today but unusually high levels of brain cancer with 48 cases mentioned – 29% of the cancer cases, compared with around 2-3% UK wide today, (see Figures 3 and 4, p. 56).. It is possible some were misdiagnosed but when looking at patient notes, two cases mentioned brain cancer, one included a post-mortem which concluded a gliosarcoma was present in the brain.[13] The reasoning for this anomaly should be researched further. After some discussion it could be reasoned that rates were high due to the severity of brain cancer symptoms. This would force a patient in a society that normally wouldn't go to hospital for symptoms such as abdominal pain (which could be a symptom of certain cancers). This meant more cases of brain cancer would have been brought into the hospital than other types of cancer. As shown by the post-mortem case above the age of onset could be younger than other cancers such as lung or colon. The age of the population in Whitechapel was younger than today with many children dying before they were five and only a small number of people reaching seventy.

Medications used in cancers generally centred around palliative care with pain killers such as morphine; in the other case of cerebral tumour a mixture of iron and strychnine was used, possibly as an attempt to kill the tumour.[14] Surgery was the most common treatment of cancer but many tumours were inoperable due to the fact symptoms had been ignored and the cancer had spread.

Asthma

Cases of asthma were low, with 19 patients and one death.[8] In one case a five-year-old boy was admitted to The London with asthma and was given a laxative (magnesium sulphate mixture), a mixture of lobeline (which contained tincture of lobeline, potassium iodide, tincture of stramonium containing atropine to cause paralysis of the airways and therefore prevent spasms, and camphor water). Also he was given oxygen, pulverised lobeline for inhalation and liquor of adrenaline.[16] It's interesting to see the use of inhalation as a delivery method. Lobeline is no longer used as it has unpredictable effects on the body due to its agonistic effects on nicotine receptors. The number of asthma patients has soared in recent time and salbutamol is one of the most prescribed drugs.[12]

Endocrine

Hormonal conditions such as hypothyroidism and diabetes were seen in the 1914 records as well as their treatment in the pharmacopoeia. Injection of pancreatic extract, isolated from pigs was used for diabetic patients and thyroid extract was used for hypothyroidism.[1] Like today thyroid conditions affected many more women than men, 43 to 6 at the London Hospital in 1914. There were 50 cases of diabetes in 1914 with a 22% mortality rate.[8] There were mentions of complications of diabetes including amputations in a few case notes.

War

1914 was of course the start of World War I. Whilst looking at the records it was noted that suddenly an unusual range of conditions was coming into the hospital records in September 1914. For example exhaustion was deemed strange as no one would have gone to hospital for such a thing in 1914; then it was realised that these were soldiers already coming back from the front line. There were many young unemployed men from the East End of London who would have been some of the first to sign up to fight for the country. It was also thought that the war would be over by Christmas.

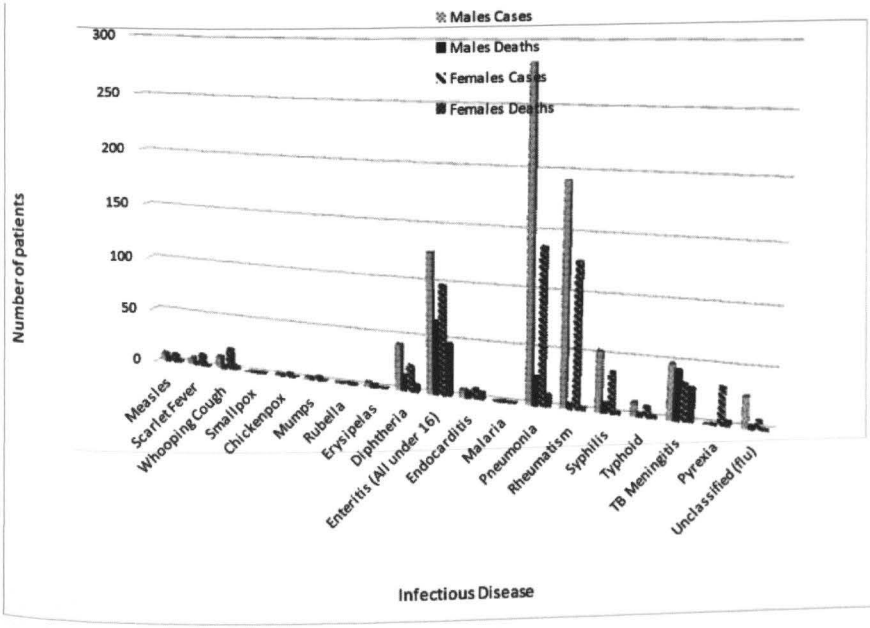

Figure 2. Rates of cases and deaths at The London Hospital in 1914

Conclusions

It is fascinating to see the types of medicines that were used in 1914 as well as the conditions and formulations and just to get a glimpse of the lives of the people that were treated at the London Hospital all those years ago. The changes and advances in pharmacy and treatment over 100 years are incredible. One of the main focuses is the shift from just treating ailments and preventing them happening in the first place. Just imagine what pharmacy and medicine will look like in 100 years from now.

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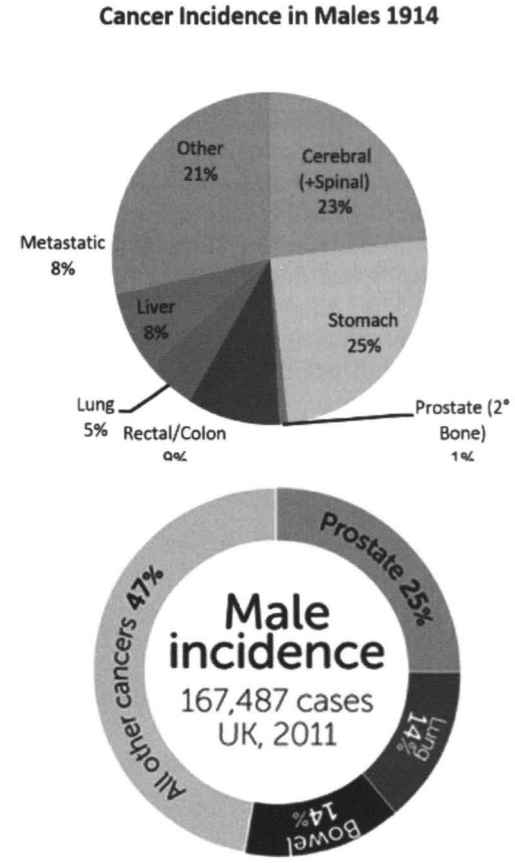

Figure 3: Cancer incidence in Males in 1914 compared with current incidence for the UK.[15]

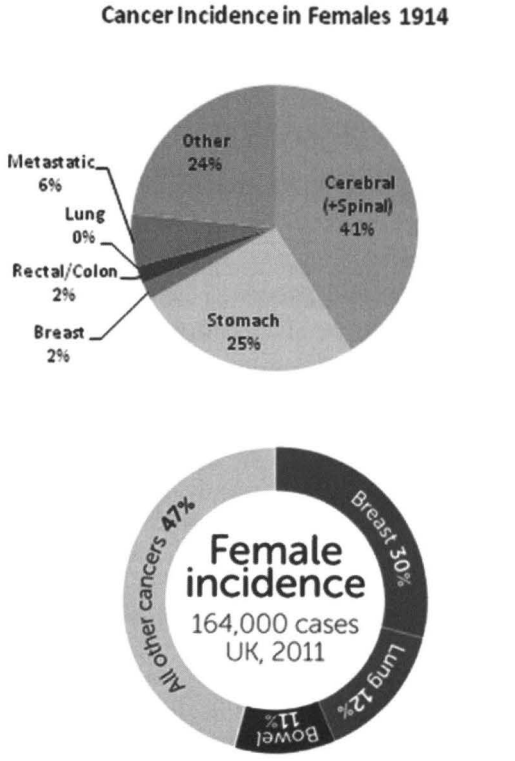

Figure 4: Cancer incidence in Females in 1914 compared with current incidence for the UK.[15]

March 2015, Sunderland as the Burnby Award Lecture for 2015.

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Philological Study on the History of Indian Pharmacy

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This paper is based on Sharma PV's work, *History of Medicine in India (From Antiquity to 1000 A.D.),* New Delhi: the National Science Academy, to which insights from modern research into esoteric religion are combined.

1. Pharmacy in Ancient India (circa 1500 BC to the 5th century AD) and *Āyurveda*

Herbal knowledge has been the foundation of medication since antiquity. Ancient Indian medicine can trace its origin to a myriad of deities celebrated in the Vedas. Believed to have been composed around 1200 BC, the *Ṛg-Veda* is the oldest of the scriptures passed down from the Aryans who migrated to the northwestern reaches of the Indian subcontinent around 1500 BC. This scripture records how the people of this period prayed to deities for blessings such as longevity, good fortune and victory in battle. It also contains hymns with magical properties such as the *soma-sūkta* and *Oṣadhi-sūkta*, in which *soma* is described as a climbing vine that produces a milky liquid. Moreover, *soma* as described in the *Ṛg-Veda* is identified with the moon God, and is referred to as the 'king of the medicinal herbs'.[1] A variety of medicinal plants such as *soma* are likewise used in the *puja* (rituals) found in the Vedas. Some other descriptions related to medicinal and pharmaceutical plants in the Vedas and other Indic scriptures are cited below and discussed to provide an overview of the genealogy of medicine as it appears in Indian mythology.

In the *Ṛg-Veda*, the *soma* plant is described as a vine. The *soma* also refers to a sacred drink, which is in essence a stimulant beverage made by pounding the stalks of the *soma* plant with stones to squeeze out liquid which is filtered through a wool sieve and mixed with a moderate amount of water and other liquids such as cow's milk. In Vedic rituals, *soma* was offered to deities as libation poured into sacred fires, with the remainder consumed by priests and other ritual participants, while its efficacy and preparation process were deified and sung by poets. The processes of collecting and preparing *soma* and other medicinal plants were considered sacred. Thus the knowledge and techniques of extracting and purifying natural drugs with instruments and equipment can be regarded as an important heritage of ancient Indian pharmacy.[2]

The *Atharva-Veda*, believed to have been compiled around 1000 BC, is a compendium of curative procedures for exorcising demons, popularly believed to cause illness, and magical incantations for granting the various wishes of the people.[3] The Atharva-Veda describes two kinds of magic. The first of them 'imprecates', or enchants, an opponent. The objective of this kind of magic is to cause illness and misfortune on the part of the enemy. In contrast, the second kind of magic, called Bheṣajāni, is of a medical nature, related to therapies and potent medicinal herbs. For example, a medicinal plant with an attached talisman inscribed with magical incantation was supposed to have curative efficacy. Water was also believed to have significant power as a medicinal drug. Medicine in this period was closely associated with magical and religious practices.

The introductory section of the ancient Indian epic *Mahābhārata* describes the beginning of the universe with a detailed account of the creation of all the deities and living things in the world. Regarding plants, the forest is portrayed as a symbol of abundance and the prosperity of the maternal womb, as an entity that nourishes the myriad animals with its trees and plants. Typical depictions of medicinal plants include how the plants that thrive on the slopes of Mount Meru emanate divine light, and how amṛta, an elixir of immortality, is created by churning the 'ocean of milk' to extract the essence of trees that then mingles with the seawater. The origins of plants associated with deities are described in the *Purāṇa*, an Indian collection of epic poetry, ancient tales and legends.[4] The ancient Indian study of medicine is known as *Āyurveda,* which is an auxiliary *Veda* belonging to the *Atharva-Veda*. *Āyurveda,* a combination of the Sanskrit words for 'life' (*āyur / āyus*) and 'learning, knowledge' (*veda*), is traditionally held to have been conceived by Brahmā, creator of all of the entities of the universe. Legend holds that this knowledge was revealed to Dakṣa Prajāpati by Brahmā in the early Vedic period, thought to be around 800 BC. Then, in the late Vedic period, Indra learned medicine from the twin Aśvin deities and transmitted this knowledge to the sage Bharadvāja, from whom the knowledge later passed on to Ātreya according to the legend. From the time of Ātreya, the legendary accounts begin to assume some credibility. Tradition holds that Ātreya had six disciples. One of these was the sage Agniveśa, whose teachings are said to have influenced the medical tradition founded by the physician Caraka, author of the *Caraka-saṃhitā*, a medical treatise that came to form the basis of the internal medicine component of *Āyurveda*. There is also a separate line of tradition held to have been inherited from Indra by Dhanvantari, then passed down to the legendary physician Suśruta.[5] This tradition became established as surgical medicine through later revisions and annotations to the *Suśruta-saṃhitā* by Nāgārjuna. Between the 6th and 5th centuries BC, a medical school is believed to have existed in Taxila in northwestern India, where the physician Jīvaka studied the theory and practice of Āyurveda.

Āyurveda holds that all the materials in the world are composed of five basic elements of earth, water, fire, air and ether, and that the human body is an aggregate

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transformation of these five elements. Pairs of these elements in the body form three humours (*doṣa*), called *pitta*, *vāyu* and *kapha*. According to the *tridoṣa* theory, illness results from disturbances to the balance among these three humours. In this way, *Āyurveda* explains the basic principles of the functioning of the human body by identifying correspondences between the human bodily functions and the observed phenomena in the natural world.

Regarding Basic Literature on *Āyurveda*

The *Caraka-saṃhitā* (*CS*),[6] *Suśruta-saṃhitā* (*SS*)[7] and *Aṣṭāṅga-saṃgraha* (*AS*)[8] are famous as the three great medical texts of ancient India. Since *AS* is a compendium based on the former two, *CS* and *SS* are commonly known as the two great works of Ayurvedic literature. The *CS* is based on *Agniveśa-tantra*, in which Agniveśa first summarised the teachings of Ātreya. It acquired its present form as the result of repeated revisions and reorganisations. A different legendary account holds that the text was completed by Dṛḍhabala, a physician who lived in Kashmir in the 8th and 9th centuries AD and is believed to be responsible for the addition of Chapter 17 at the end of Text Six, as well as the addition of Texts Seven and Eight. The current edition of the *CS* comprises eight books and one hundred and twenty chapters.

Substantively, *Āyurveda* is premised on a tradition of eight disciplines. As for the basic principles of treatment, it defines the 'four pillars of treatment (physicians, drugs, nurses and patients)' and recommends dietary and drug-based treatment regimens. In addition, *Caraka* classifies drugs into fifty separate groups according to their medical effects. The *CS* is understood to have been influenced not just by medical knowledge, but also by the somatic theories of the *Sāṃkhya* school, the theoretical logic of the *Nyaya* school, and the natural philosophical categories of the *Vaiseshika* school. The name 'Caraka' is believed to refer to itinerant physicians who travelled around the country to tend and treat the ill. Conversely, passages in the Chinese *Fu-fazang-yinyuan-zhua* (付法藏因緣傳)['History of the Transmission of the Dharma Storehouse'] and the Chinese translation of the *Tripiṭaka* also suggest a link between the *CS* and a physician in the 2nd century AD at the court of King Kaniska. The *CS* was translated into Arabic and Latin in the 8th century, Persian in the 9th century and into English from 1890. On the other hand, *SS* deals primarily with surgical medicine. The fact that Suśruta discusses differences between his own way of thinking and that of the Ātreya school as to the number of bones in the human body suggests that Suśruta came after Ātreya. Yet, there is little evidence available to determine the period when Suśruta was active. The *SS* is based on the *Śalya-tantra*, believed to have been compiled in the 2nd century BC. It is believed that Suśruta supplemented this text with the *Uttara-tantra* to complete the *SS* sometime before the 2nd century AD. Ḍalhaṇa, the author of a commentary on the *SS* active in the 12th century, argued that revisions to the text were made by Nāgārjuna. However, scholarly opinion generally makes a distinction between the physician Nāgārjuna and the Buddhist scholar of the same name. *SS* comprises five books and one hundred and twenty chapters. Drugs are therein classified into thirty-seven different groups according to their nature and medical efficacy. Over one hundred types of medical equipment and over twenty types of steel surgical instruments are listed, including knives, scalpels, lancets, saws and scissors. Book Three, alongside a systematic observation of functional, developmental, and structural aspects of internal organs, explains the importance of surgical procedures and discusses a primitive stethoscope with a tubular instrument, plastic surgery to create artificial earlobes, incisions using cucumbers or gourds and phlebotomy techniques making use of a lotus stem. For these reasons, Suśruta is regarded as a pioneer in the field of surgery.

The *Bower Manuscript*

These two great works mentioned above are thought to be related to the *Bower Manuscript,* which is a birch bark manuscript of fifty-four leaves purchased in 1890 by a British Lieutenant Hamilton Bower in Kucha in East Turkestan. This is an example of a treatise describing ancient Indian pharmacy.[9] Written in the Gupta script in a format used in Buddhist scriptures, the manuscript contains formularies included in the *Āyurveda*, divinations and incantations, and contents associated with Buddhism. The *Bower Manuscript* was deciphered by AF Hoernle and an annotated English translation was published in the years between 1897 and 1912. Named the *Bower Manuscript* in honour of the man who discovered it, it was initially determined by philological research to have been written sometime between 350 and 375 AD. There are, however, palaeographical reasons to place the date between the 4th and 6th centuries AD[10] and current research reports that it was written between the beginning and the middle of the 6th century.[11] In particular, the second part of the *Bower Manuscript*, which is called the *Nāvanītaka*, is intended to provide a standard manual of the foremost medical formulae as 'approved items'. The composition and contents of the 11th chapter of the *Nāvanītaka*, which is a monograph on *harītakī* (*Harītakī-kalpa*) that supposedly corresponds to the plant *Terminalia chebula* Retz., are also listed in the Ayurvedic Pharmacopoeia of India. According to the *Harītakī-kalpa*, herbs can also be applied to various symptoms caused by the disorder of three humours as a depurative or as a tonic for perpetual youth and longevity. The discovery of the manuscript later triggered a flow of expeditions along the Silk Road and in the Western Region of China. The manuscript is presently preserved in the Bodleian Library at the University of Oxford. (Figures 1, 2)

2. Pharmacy in medieval India (from the 6th to 17th centuries)

The pharmacological history of medieval India had large scale interconnections with religious medical practices in Asia, the Middle East and Europe. This section draws on major medical books at the time to outline the history of pharmacology with

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ARCHÆOLOGICAL SURVEY OF INDIA

THE BOWER MANUSCRIPT

FACSIMILE LEAVES, NAGARI TRANSCRIPT, ROMANISED TRANSLITERATION AND ENGLISH TRANSLATION WITH NOTES

EDITED BY

A. F. RUDOLF HOERNLE, C.I.E., M.A., PH.D.

LATE PRINCIPAL, CALCUTTA MADRASAH

Published by Order of the Government of India and under the Patronage of the Bengal Government

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1893—1912.

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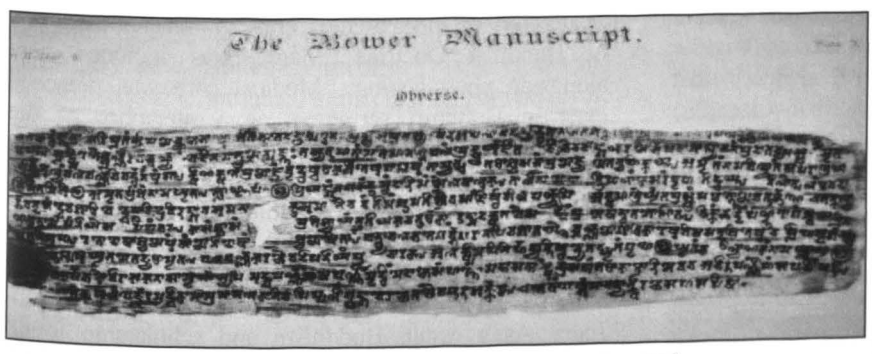
Figure 1. Title page of the *Bower Manuscript*, 1912.[9]

particular focus on the relationship between religion and pharmacy.

Early in the 7th century, there was a growing trend toward *tantrism*, a common concept among Indian religions. This trend subsisted till the 13th century with the 9th century celebrated as the golden age of *tantrism*.[13] *Tantra* means 'warp of a loom' in Sanskrit, but its significance is not clearly explained in the scriptures. *Tantra* deals with natural sciences such as astronomy, mathematics and medicine, as well as the legal field of everyday life. In the 6th century, *Varāhamihira* wrote in the *Bṛhat-saṃhitā* about the use of mercury or iron in combination with medicinal plants to prepare an aphrodisiac or a tonic.[14] The Sanskrit dictionary called *Amarakośa*, compiled during the same period, lays out medical formulae that make use of red lead, lead, gold, mercury and silver. These major works in medical literature are typical of the early medieval Indian pharmacology. They are based on the *Caraka* medical system and are impacted by *tantrism*.


The Bower Manuscript.

obverse.

Figure 2. *Bower Manuscript*, 1912, Plate X.[9]

Aṣṭāṅga-hṛdaya-saṃhitā

During the 7th century, *Vāgbhaṭa* II treated the same field in the *Aṣṭāṅga-hṛdaya-saṃhitā* (*AHS*) as *Vāgbhaṭa* I's *A*.[15] It is a formulary that comprises *CS* and *SS*. It was translated into Arabic in the 8th century and into Tibetan in the 11th century. (Figure 3, p.60.)

Mādhavakara Nidāna

The *Mādhavakara Nidāna*[16] is famous because it contains the writings of *Mādhava*, who was active between the 7th and 8th centuries. It is a commentary on the causes of diseases and is based on three major medical textbooks in ancient India. It was translated into Arabic in the 8th century and into English in the 20th century. While it describes drugs that cause diseases, the amount of pharmaceutical content is smaller than that found in the three major medical textbooks in ancient India.

Siddhayoga

Vrinda authored the *Siddhayoga* in the 10th century. It cites formulations from the works of *Caraka*, *Suśruta* and *Vāgbhaṭa* and was used for preparing various compounds for eye drops.

Cakradattadīpikā

According to Cakrapānidatta (active circa 1060), the Cakradattadīpikā comprises notes on *CS*. It refers to the Siddhayoga of Caraka, Suśruta, Vāgbhaṭa and Vrinda and is related to the rituals of tantra. It uses iron powder, copper powder and talcum powder as therapeutic agents.

Early Uses of Metals in Medicine

In the time of the Veda, soma and its juice represented early Indian alchemy and were used for worshipping the gods. The word rasāyana, which means 'the juice of', originates from somarasa, which is known as a drink that makes men and gods incredibly cheerful. Rasa implies 'mercury'; thus, rasāyana means mercury medicine, i.e. mixture of mercury with medicinal plants, or the Elixir of Life. Thus, alchemical processes using various medicinal plants gradually came to take the form of formulations containing mercury. For example, in the *Atharva-Veda*, gold, having a noble nature, is described as being present in the elixir of longevity whereas curses and magic are recommended as ways of treatment. In later generations, men sought pleasure rather than relief from disasters, pains and diseases, in opposition to the actions of the shaman *Atharvan*. In those days, authorities saw *Atharvanic* healing as an evil occupation, and alchemy was a mysterious art and science of converting one substance to another; it was a magical art taught only to disciples in esoteric religious organisations. Thus, Indian alchemy originated in the *Veda* and had a deep connection to *tantric* prayer therapies and longevity concoctions for rejuvenation and rebirth.

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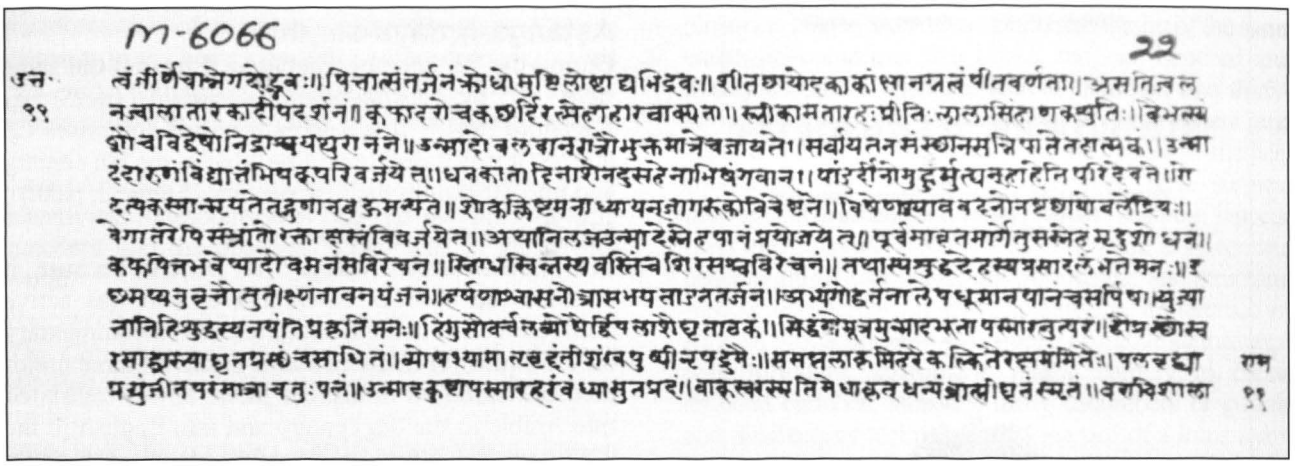

Figure 3. *Aṣṭāṅg-hṛdaya-saṃhitā* (around 15th century). Image courtesy of DAV College Library, Chandigarh.

During the 11th to 13th centuries, pharmacology was under the influence of *tantrism*, and thus, *tantric* rituals began to be favoured. In alchemy, however, we find a precursor to medicinal chemistry. Here, I would like to discuss the three main *tantric* works in the literature that are related to alchemy.

Rasaratnākara (Treasure Trove of Mercury and Gemstones)

The *Rasaratnākara* is a work from the 7th and 8th centuries, before Muslims entered the northern parts of India. It is a *tantra* from Mahayana Buddhism related to alchemy. It contains the chemical knowledge revealed to the author *Nāgārjuna* by *prajñā-pāramitā* (complete wisdom) that appeared in his dream. In addition to mercury/mercury sulphide formulae, methods for metal purification, metal and gemstone polishing and mercury solidification as well as the apparatus used for these processes, the elixir of longevity is discussed here.

Rasārṇavakalpa (The Unlimited Power of Mercury)

This is an Indian metallurgy classic of unknown authorship supposedly written during the 11th century. *kalpa* refers to something that can be operated by its own potential and it can more specifically refer to the power of various metals for transforming base metals such as copper and lead into silver and gold. It classifies substances on the basis of their potential to transform metals. *Kalpa*, written in the form of a dialogue between Śiva and his companion Pārvatī, provides a mythical description of the process of alchemy and the origin of plants, minerals and mineralised water. It emphasises the tantric ritual performed before using the material and represents a phase of alchemy that emphasises the immortal quality and metamorphic processes of a substance.[17]

Rasaratnasamuccaya (Collection of Mercurial Treasure)

The *Rasaratnasamuccaya,* authored by *Vāgbhaṭa*, is a literary work from the 13th century on metallurgy, Ayurvedic therapy and pharmaceuticals. The first chapter lists the names of 27 scholars of mercurial study (*rasa-śāstra*), among which appear the names of *Nāgārjuna* and *Nāgabodhi*. It preaches the auspicious importance of *rasa* (mercury). *Śiva* is the god who governs *rasa*, which is regarded as his essence or semen. Thus, the text reasons that *rasa* has the power to absorb all metals and the ability to heal and prevent ageing, pain and death.

Medical Chemistry and Tantrism as Late Esoteric Buddhism

Esoteric Buddhism is a part of *tantrism* founded by *Nāgārjuna* in the 7th century. In the 7th century it was influenced by Mahayana Buddhism and became Tantric Buddhism, which was practised in India between the 8th and 12th centuries. It was at the same time absorbed into Brahmanism and Shaivism *tantra* between the 7th and 8th centuries with the decline of Buddhism. Between the 10th and 13th centuries, *Tantric* Buddhism integrated with a Hindu sect to form *haṭhayoga*. In this sect, the use of chemicals such as mercury, sulphur and mica is believed to be essential for longevity. Some of the chemicals are used by *Atharvan* for medical treatments.

From the 11th to 12th centuries, before the Muslim invasions, Vikramaśīla University was one of the two most important centres of Buddhist learning in India, the most important being the Nalanda University. Chemistry and medicine, as well as Buddhist philosophy, were part the curriculum of study there. Buddhism in medieval India had a significant impact on medicine. The ties between medicine and Buddhism in India date back to ancient times. During the ancient times, medicine (*vyādhi-cikitsā-vidyā*) had taken on a broad meaning as one of the five sciences (*pañca- vidyā-sthānāni*) defined as auxiliary sciences by the Centre to Preserve the Study of Buddhist Doctrine. Magic was included here alongside pharmacology. Medical care was preached even in Buddhist scriptures as a metaphor of the doctrines. These descriptions contain the same contents as *Āyurveda* and discuss treatments to prevent pain, sickness and old age. Among them, *Vikramaśīla Mahāvihāra* was destroyed by Muslims during the 13th century. Learned priests were killed, but, some of them, who excelled in learning, fled to Nepal, Tibet and South India. As a result, Buddhism and scholarship found asylum in the areas where they sought refuge, thereby

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propagating medicine and Buddhism in various regions. In this way, Buddhist scriptures also found their way to China because of the Chinese translations and began to be integrated into Chinese medicine.

Pharmacology after the Muslim Invasion

Kālacakra tantra was compiled in the 11th century from the words of Buddha in his later years. It is well known as the late Esoteric Buddhism's most holy scripture. It is a representative scripture of Anuttarayoga Tantra, the most esoteric form of Tibetan Esoteric Buddhism, and deals with the signs of death that is outside the medical causal theory that *Caraka* and *Suśruta* and preach. Then, during the 12th century, pulse diagnosis was introduced from Tibetan medicine. Also, between the 11th and 12th centuries, an encyclopaedia of medicinal plants (*nighaṇṭu*) was compiled that intended to identify medicinal plants found in ancient medical literature. During this same period, use of mineral drugs became popular. South India established a system of medicine called *siddha* that used mineral drugs, primarily mercury. After the 13th century, it was influenced by the Islamic medicine, *unani*. This medicine was created in the 11th century on the basis of the Greek medicine by the Persian (currently Iranian) physician-philosopher Ibn-Sīnā [Avicenna].[18] Then, in the middle of the 15th century, foreign medicinal plants, such as opium poppy and kino, were introduced for drug treatments. Also, Chinese merchants brought syphilis from Portugal to Goa in West India. This was treated using mineral acids, such as phosphoric acid or arsenic acid, as therapeutic agents, which had the property of dissolving metals. Insoluble mercury was also prepared for mercury's sterilising and insecticidal applications. In the 16th century, Indian medical literature described the validity of exotic drugs. Thus, practising alchemists as well as people who pharmaceutically use mineral drugs greatly contributed to the development of pharmacology in medieval India.

3. Pharmacy in Modern India (From the 17th century to the present)

Since Dutch, English, and French expansion into India in the 17th century, *Āyurveda* has been in contact with Western medicine. As a result, in practical aspects, Western medicine was gradually incorporated into Indian medicine. In the early 19th century, Indian medicine was further westernised, but movements to revive traditional Indian medicine occurred throughout India, notably Bengal, with the rise of independence movements. What was revived, however, was an eclectic one with significant deviations from the classic. Traditional medicine, while embracing Western medicine, attributed the decline of *Āyurveda* to the introduction of Western medicine.[19]

Formal pharmacy education in India began with a course taught at a medical school in Madras (currently Chennai) under British rule in 1860, focusing mainly on practical prescriptions and principal compounds of the *British Pharmacopoeia*, which was enforced in India in 1885. This school was designated as a 'college' in 1860, and the institution came to be known as the Madras Medical College.

In Britain, apothecaries had separated from grocers during the 17th century. By the early 18th century, apothecaries achieved some recognition as medico-pharmaceutical practitioners. Two groups of apothecaries arose: one group was mainly interested in the practice of medicine and the other in pharmacy. From the latter emerged chemists and druggists, who were expected to have practical knowledge of pharmacy.

In India, a 'chemist' or 'druggist' course had been taught since the 1870s. In colonial India, this was the only course of its kind and standing, geared to providing qualified manpower for pharmacy practice and governed in line with the instructions imparted by the Pharmaceutical Society of Great Britain. In 19th-century India, those who specialised in pharmacology were given the English title of chemist or druggist. Similarly, in 1894 the Madras Medical College began to grant certificates of chemist and druggists to those who attended all courses in pharmacy and chemistry including practical subjects. Thus, the pharmaceutical profession under British rule transformed from 'those who dispensed' into 'those who are scientifically educated.'

The Institutionalisation of pharmacy in modern India

Right after independence, the Indian government enacted the Pharmacy Act in 1948, which established the standards for education and qualifications for pharmacy practice.[20] Thus, graduates of a diploma course, which consisted of two years of classroom education and three months of practical training, were recognised as pharmacists who were licensed to dispense and sell pharmaceuticals. The Pharmacy Act required each state to establish a pharmacy council to which regulation and registration of pharmacists were mandated. To implement the act, the Pharmacy Council of India was established in 1949.[21] The framework of pharmacy education in India was formed this way. As new dynamics in pharmacy in India between 1930 to 1931, the Indian government established the Drug Enquiry Committee. This committee made recommendations for legislation to regulate the pharmaceutical industry, drugs, and the government. The foundation was thus laid for the development of the pharmaceutical profession and the chemicals manufacturing industry, which created the greatest challenge for developing a competent human resource pool for pharmacy education.

Madan Mohan Malaviya, president of the Banaras Hindu University, recognised the importance of the aforementioned recommendation and Mahadeva Lal Schroff was tasked with the mission to promote pharmaceutical education in the university.[22] Along with this task, Schroff, who was entirely aware of the need for high quality, affordable texts in pharmacy education, wrote textbooks with his former student GP Srivastava and other people which contained principles of pharmaceutical chemistry, commentary on pharmaceutical arithmetic, and general pharmacy.[24] Schroff wrote six textbooks, including some that were co-authored. Overall, 23 works related to pharmacy are attributable to

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him. Currently, this is a record number for lifetime publications in Indian pharmacy. (Figure 4).

Schroff also carried out studies on the history of pharmacy in their mother country. From 1950 to 1953, he repeatedly contributed papers on his research results to the American Institute of the History of Pharmacy. These works were gathered and reprinted as *History of Indian Pharmacy* by Srivastava in 1953.[23] These works explain the processes of drug formulation in ancient times in their every aspect and comments on what relevance they have to the origin of Indian pharmacy (Figure 5).

Now let us turn our attention to the potential in all aspects of drug discovery and development in India. The concept of a pharmaceutical central research institute that was proposed by Schroff to the government of India in 1954 was taken over by Harkishan Singh. At that time, Singh was a professor at Punjab University. In respect of pharmacy education, it is worth briefly mentioning the National Institute of Pharmaceutical Education and Research (NIPER).[25] In 1991, the first NIPER was founded in SAS Nagar, Mohali, Punjab, 250 km north of

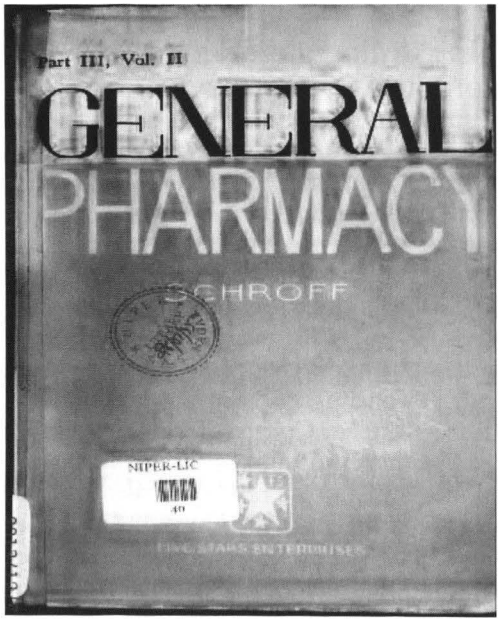
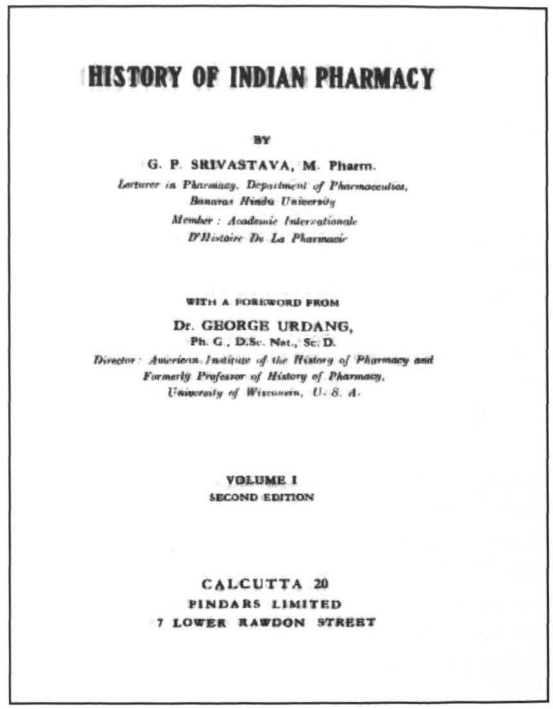


Figure 4. Title page of *General Pharmacy,* Part III, Vol. II, referred to in Indian Pharmacopoeia (1966), British Pharmacopoeia (1968), the British Pharmaceutical Codex (1968), and United States Pharmacopeia, XVII, (1965).

Delhi. It is a state-of-the-art pharmacy education institution that symbolises contemporary India. This NIPER, the first national level institute in Indian pharmaceutical sciences, is to become a centre of excellence for advanced studies and research in pharmaceutical sciences. Since then, six NIPERs have been established – at Ahmedabad, Hajipur, Hyderabad, Kolkata, Rae Bareli, and Guwahati. Now Singh is a Professor Emeritus of Punjab University and recognised as the leading authority in the modern pharmaceutical history of India.

As for hospital pharmacy, in 1963 the Indian Hospital Pharmacists Association, inaugurated by Bhagwan Dass


HISTORY OF INDIAN PHARMACY

BY

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WITH A FOREWORD FROM

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Figure 5. Title page of Volume I of *History of Indian Pharmacy*.

Miglani, assumed the central role[26] in arts and sciences of hospital pharmacists and disseminated opinions on medical reforms and pharmacy to the public. The Indian Pharmaceutical Congress began publishing a bimonthly journal *The Indian Journal of Hospital Pharmacy* in 1964. This journal is still published today.

Conclusion

In this paper, major works in Indian pharmacy from ancient times to the present were listed and outlined. Indian pharmacy has its origins in mythology. In the Middle Ages, gold and *rasāyana* for longevity respectively corresponded to alchemy and perennial youth or long life. The fusion of these two coincided with a new tide of *tantrism* in India. Since before independence, Indian traditional medicine had been incorporating Western medicine. Currently, *Āyurveda*, modern Western medicine, Unani, Tibetan medicine, and Siddha are performed concurrently and characterise pharmaceutical practices and drug discovery in India. Various works in Indian pharmacy have been handed down in pharmaceutical education.[27]

Acknowledgments

I am very much obligated to Dr Harkishan Singh, Dr Bhagwan Dass Miglani and Dr Jun Okuda for reading this work and for helping me to gain access to many valuable texts. This study was made possible through research in the Bodleian Libraries, the University of Oxford under Japan-India basic pharmaceutical scientific cooperation literature research at National Institute of Pharmaceutical Education and Research NIPER, S.A.S Nagar, Punjab (2014), as well as by Meijo University Grant-in-Aid for International investigation (2013) and a scholarship established by

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Book Notice

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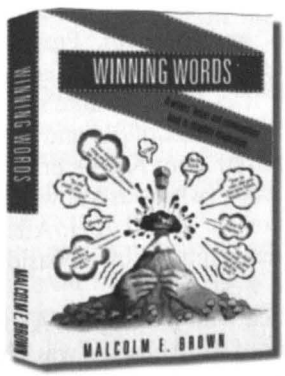

This book by retired pharmacist and BSHP member aims to inspire and help writers develop imagination and ideas. Pharmaceutical history is used, based on the author's pharmacy background.

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Drugs and Pharmacology in the Islamic Middle Era

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The Islamic Middle Era is an important historical period due to the separation of pharmacology from medicine and its development as a specified branch of medical sciences. Pharmaceutics, toxicology, production of narcotic drugs, publication of herbal books and pharmacopoeias developed in this era. The Abbasid Caliph (King) ordered legislation on pharmacology and these laws played an effective role in promotion of this science. The aim of this study was to show the process of development and specification of pharmacology in the Islamic Middle Era and discuss some influential factors in this promotion.

Medicine and pharmacy

The scientific movement in Islamic civilisation did not occur due to Abbasid and Omavian politics; it was the direct result of Muslims' relationships with civilised nations like Iranians, Greeks, Syrians, Hebrews and Indians which were accompanied with Islamic teachings about seeking knowledge. In this regard prophet Mohammad (PBUH) said, "Seek knowledge even if it is in China".[1] This encouraged Muslims to search and learn knowledge even if it was in China and had risks for their life. So, Abbasid Caliphs supported scientific development for their political goals and used its results for their governmental plans.

The Abbasid dynasty was the second dynasty of Islamic Caliphs which ruled after the Omavian [Umayyads] from 132 to 656 A.H. [750-1258 AD] Their great ancestor was an uncle of Prophet Mohammad, *Abbas ibn Abdolmotalleb*, so they called their dynasty Abbasid or *Ale-Abbas*. Shiite's of Khorasan released *Abol Abbas Abdollah* and his brother, *Jafar* (*Mansour* Caliph) from Kufa's prison for allegiance to the *Abol Abbas* (who was known as '*Saffah'* [killer]) in Kufa mosque in 132 A.H. After that, all the Islamic lands were captured by Abbasids (from Send in the east to the west).

The Abbasid dynasty started with the reign of Abol Abbas, but the main founder of the Abbasids was his brother, Mansour, who was Caliph for 21 years and the other 35 Caliphs after him were his descendants. He built Baghdad city as his Caliphate's centre.[2] In the *Harun al-Rashid* period, Baghdad gained its higher position as capital of Abbasids because of Iranian, Indian and Syrian's scientists and healers.

Non-Muslim scientists encouraged Muslims to acquire the science and knowledge of earlier scientists. At first, Muslims thought all other sciences, except medicine, were against Islam. But when physicians went to the Caliphate, they tried to teach philosophical and logical knowledge to the Caliphs. Therefore, Caliphs no longer burned the books of conquered cities and countries. They wanted their soldiers to gather and transfer them to Baghdad for translation into Arabic. As some books from conquered cities like Ankara and Amorium were transferred to Baghdad, they were translated into Arabic by '*Yuhanna ibn Masawaih'*, Physician of *Harun al-Rashid*.[3]

Mamoun (one of the Abbasid Caliphs) also sent a letter to the Roman king and wanted him to send any books of old sciences. He sent to Rome some scientists like *Hajjaj ibn Matar*, *Ibn Betarigh*, and *Salma*, the supervisor of '*Beyt Al-Hekmah*' (House of Wisdom, a great and famous library established in Harun al-Rashid period), for gathering and translating books.[4] Unfortunately, all these great activities were not continuous and after *Mamoun* the Caliphate's system and scientific situation changed.[2] The last Caliph of the Abbasids was *Al-Mu'tasim* who started his Caliphate in 640 A.H. [1252] In 656 A.H., *Holakookhan* was sent to Baghdad to open *Esmailian* gates and conquer Baghdad. By killing the Caliph and his children, he ended the Abbasid dynasty.[2]

Medical and pharmacological sciences entered Islamic civilisation from the translation movement in the Islamic middle periods. Medical sciences, especially pharmacology, developed and because of cohesion and unity with medicine, they couldn't be differentiated from each other.

Some pharmacological books translated from Greek to Arabic in the Islamic middle era included *Tarkib-Al-Advieh* (drugs mixture), *Al-Advieh Al-Mofradeh* (single drugs), *Ghova-Al-Aghzieh* (foods potency), *Al-Advieh Ao Al-dava* (drugs or drug), *Al-Oram* (the swellings), and *Al-Teriagh* (The Book of Theriac).

Also some Indian books like the book of *Indian drugs names* were translated from Hindu to Arabic.[5] At that time, medical discussions and subjects were deeply related to phytology. So, pharmacies had an important role and position in hospitals for their medicinal plants.

A pantry (or syrup providing centre) was a room in which drugs were prepared. Before this period, Arabic pharmacological books included simple drugs with animal, plant or mineral sources and compounding drugs (aqrabadins), most of which are forgotten today.[6] In fact, Muslims paid much more

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attention to the therapeutic effects of plants, so pharmacology switched to practical herbal medicine.[7] Islamic scientists were then the best in the pharmacological field. At first, they learned about all kinds of drugs from Greek books like the *Materia Medica* of Dioscorides. This book was translated into Arabic by *Estefan ibn Basil* and edited by *Hunayn ibn Ishaq* (Johannitus).[8] In fact, Muslims resurrected the phytology which was being forgotten in Greece after Theophrastus. Muslims of the Islamic Middle Age were more advanced in pharmacology and the natural and chemical history of simple drugs than the Greek and Latin nations of the time. Latin and Greek herbalists were then directly and indirectly influenced by Arabic books of the 9th and 10th centuries AD, because Islamic lands had spread from China to Andalusia.[3,9]

It is known that Iranians in the *Sassanid era* were expert at pharmacology and many Iranian names of medicines from that time are still used, especially for compound medicines. For example, in the Sassanid period, a group of physicians named *Oroor Pezeshk* (plant physician) tried to cure and heal their patients with extracts of herbs and medicines. The ability and status of these physicians of the Sassanid dynasty in Iranian society is comparable with pharmacists and pharmacologists of the Islamic Middle Age. There are no instructions about the preparation of medicines and extracts of plants in Avestan [an Old Iranian language] texts, but Greek and Islamic historians and even medical books commented on Iranian's ability to prepare different and effective medicines which amazed Greeks and Muslims.[10]

During the Islamic Era Iranians continued the way in which pharmacology was developed and surpassed the knowledge of Theophrastus and Dioscorides. This tradition culminated in the Safavid period which was named the Golden Age of pharmacology. Muslims divided medicines into two groups: simple and compound, and called them *Aghaghir*. There were different kinds of pharmacological books: on poisons, lists of compounding drugs, summarised essays (that were something like today's handbooks) and aqrabadins (taken from the Greek word *Craphidion*, pharmacopoeia of compounding drugs).[11] Each aqrabadin is arranged alphabetically and is a lexicon and dictionary.[9,3] Botanists supposed that if you name the plant, you should recognise and identify it, but it is only the first step of recognition. If you recognise it better, you can give it many names. They didn't try to match names with objects and find its similarities.[12]

Pharmacology was a precise and advanced science in the Caliph's territory. *Mirhouf* clarified that Baghdadi pharmacists could weigh their medicinal herbs with a Grain scale (each Grain is 65 mg). Baghdad medicine dealers limited themselves in their main profession. They had a high position in society but most of them treated patients informally. There were no limits for dealers of medicine and for physicians. Usage of medicine developed in the Abbasid dynasty and many books were published in this period. The first great writer in this field was Shapour ibn Sahl who wrote *Agharabazin-fi-Al-bimarestanat*.[4] Rhazes was one of the scholars who recognised pharmacology as an independent field but related to medicine. He was one of the first scientists who made drugs in chemical laboratories. He mentioned 800 medicines (most of them herbal) and discussed the theoretical and practical basics of pharmacology. In addition, Abu Rayhan al-Biruni was known as the founder of indigenous phytology in pharmacy.[3]

Drugs were apparently expensive at that time. Compounding drugs and medicines that were made from scarce sources were more expensive than simple ones because people thought they were more effective. However, exact information about the prices is rare. Physicians also were worried about the prices of medicines.[7] Medicines and spices were important objects of business, but patients usually couldn't buy them. Dealers in medicine worked as second-class physicians and were from the lower level of society. Medicine retailers were at the level of tricksters and illiterate physicians. Some of them cheated in the sale and making of medicines.

In the book *Tabaghat-Al-Atebba* (Order of Physicians), it was explained that there were some physicians who couldn't choose the correct medicine for treating patients; so Mamoun ordered the dealers of medicine to be evaluated. Also, Moátasam commanded that a charter be given to dealers of medicine who had enough knowledge. He assigned inspectors (called *Muhtaseb*) to supervise dealers of medicine. Of course, the main duty of inspectors was forbidding what was not right according to religion, but protecting artisans and their work was also their duty.[13]

Moghtader, another Abbasid Caliph at the beginning of the third century A.H, ordered his men to check pharmacists' competence. Based on this command, As Ibn Ghafti said that people who could prove their competence to Sanan ibn Sabet were allowed to treat patients and prescribe medicine. They gave unreal (test) prescriptions to groups of pharmacists and required them to prepare those medicines. Pharmacists who gathered and prepared the wrong medicines were rejected by the Caliph and others, who knew the meaning of prescriptions, kept their positions.[8]

Rhazes and the science of pharmacology

Rhazes is important in the science of pharmacology because of his *Mojarrabat* (Drugs which were experienced practically). This collection of clinical experiences includes 650 reports on his patients. At the time of Rhazes, patients used to explain their illnesses in different ways: they either saw the physician directly, or wrote their history for the doctor or even asked another one to explain about their problem for them. Most probably, the most interesting cases, especially those

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who benefitted from prescribed medicines, were recorded in his books and essays.[3]

One of the innovations of Rhazes in pharmacy was using chemistry and alchemy together. Up to the time of Rhazes, alchemy was a supernatural and virtual science and it was not related to experience.[14] He produced ammonia by dry distillation of animal excrements. He also categorised mineral ores and explained some chemical tools. Rhazes tried to use his chemical knowledge in medical treatments and brought many materials into chemistry and pharmacy. In addition, his discovery of alcohol and sulfuric acid were other achievements. Rhazes made alcohol from distillation of fermented sugar and starchy material and extracted sulfuric acid from the breakdown of sulfate of green alum and introduced it as a disinfectant.[15] Also, he examined the effect of mercury on monkeys and prescribed it as a diarrhoea-inducing agent.[16]

When he tried to find 'The Philosopher's Stone', which was supposed to change worthless metal to gold and silver, and 'The Great Elixir' to make an old person young, he discovered many chemical materials.[17] Kampel said in his book, regarding Arabic medicine and its influence in the middle era: 'Rhazes is the first person who entered chemical extractions in medicine. He could be considered as the ancestor and scout of chemical teachers of The Age of Doom' or 16th century. In addition to being a chemist, Rhazes was also a physicist; he used the balance of liquids for testing density.[12]

Avicenna and the science of pharmacology

Ibn Sina (Avicenna) has had a great impact on pharmacology because of his important book *Canon of Medicine*. He explained each medicine, its usage and ingredients. In addition to his knowledge about drugs presented in other books, he discussed the characteristics of herbs based on his own experiences. He skilfully categorised medicines like antiseptics, narcotics and analgesics. The fifth book of *Canon* is a course of pharmacy and pharmacology. He explained all medicines types, such as tablets, balms, pills, powders, syrups etc.[18] 800 simple medicines are explained in the *Canon* and introduced by text. Avicenna described each medicine, its nature, the best and the worst of it and its origins (mineral, herbal or animal). Also, he believed that patients shouldn't only keep to medicine; they should use diet regimens as well as warm baths and sun baths for some illnesses. He thought watery food was better for a patient's treatment (generally liquids). Then, functional foods, nutraceuticals and simple medicines should be used. At the end, if the treatment was not effective enough, compound medicines should be prescribed. Compound drugs are produced from two or more simple medicines and have different forms of elixir, pill, decoction, etc.[18]

Pharmacy or drugstore

The pharmacy or drugstore was an important place in the hospital in which documents and deeds of a hospital's buildings and its endowments were kept.[6] The pharmacy of a hospital, which was called *Sharbat Khaneh*, was like a treasury because it was generally adorned with artistic objects, porcelain and clay jars. Some pharmacies rivalled royal palaces because of these treasuries. The chief of the drugstore was named *Sheykh-e-Seydalani* or drugstore manager. This title was given to all alchemists of that time. Common employees were called major and other service workers like dishwashers or porters called *Sharbat dar*.[19,20]

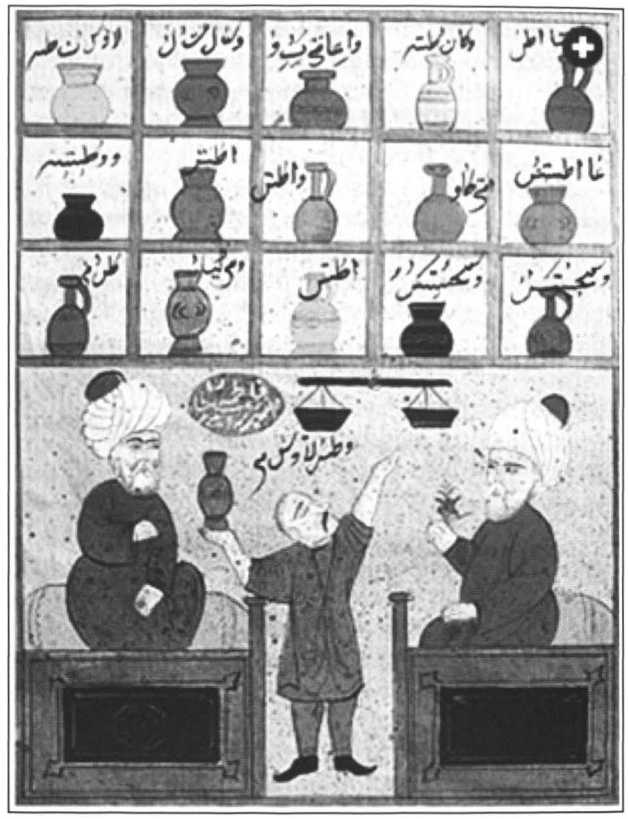

Figure 1: Islamic pharmacy image: From Golshani, SAR. *Medical History In Bani Abbas Era (A.D 750-1258)*. Supervised by: Dr SA. Foroozani. MA Thesis in Islamic History. Shiraz University. February 2012.

Pharmacists in drugstores charged the prices of medicines but one of them, named *Ibn-Al-Hazar*, condemned this job. He employed a slave in front of his house named *Rashigh* and made him give out medicine to patients and take the cash.[13] (Figure 1)

The tradition of writing herbal pharmacopoeias and aqrabadins

Writing herbal pharmacopoeia is a branch of pharmacology that started from the beginning of the translation movement. Hunayn ibn Ishaq (Johannitius) translated a book of plants from Greek to Arabic and after him many scientists and translators of Islamic civilisation started to compile their own books. Ali ibn Rabban Tabari compiled *Ferdos-al-Hekmah* and described applications of medicinal plants and herbs.[16]

Yuhanna ibn Masawaih was one of the first writers of aqrabadin. He was known as the Gospel writer of aqrabadin in Europe. Another more famous aqrabadin belongs to Shapour ibn Sahl in Jondishapour. The

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philosopher Alkandi wrote some essays about medicine and perfumes, and also wrote an aqrabadin book. Furthermore, Rhazes, the famous philosopher and physician, composed a famous aqrabadin which was translated into Arabic and Latin. In addition, Avicenna's *Canon* had a complete and comprehensive chapter about medicines which are still used in some regions of the east.[21] Ali ibn Abbas Majusi Ahvazi also described the effects of medicines on the human body.[22] He explained the application and importance of medicine and its nature (cold or hot).[23] In fact, writing herbal pharmacopoeias was an Arabic-Islamic tradition.

The first Christian Arab scientist who wrote a herbal pharmacopoeia was Ibn Sarabiyoon Asghar. Today, only one part of his Arabic essay exists but its translations into Hebrew and Latin still exist. Moreover, Ibn Telmiz wrote the most important Arabic herbal pharmacopoeia of his time (after Ibn Sarabiyoon). He was a Christian and manager of Baghdad physicians.[12] Ibn Bitar (646A.H./1175AD) compiled the most masterly Arabic herbal pharmacopoeia which was the most important work from Dioscorides until the 16th century. He traveled to Greece, Asia Minor, Egypt and other cities to find medicinal herbs. He compiled a book with 1400 medicinal herbs and influenced many Iranian writers who followed him. Ibn Bitar prepared a long list of simple medicines and their applications. Accordingly, he could be considered as the founder of writing Persian aqrabadin books.[24] In fact, Ibn Bitar's book was a botanic encyclopedia which included Greek and Arabic scientists' experiences like Dioscorides, Galen, Rhazes, Avicenna, Edrisi and others.[12]

Ibn Moskooyeh, a philosopher and historian contemporaneous with Avicenna, also had a book named *Al-mofradat* (simple medicines). But, *Abu Mansour Movaffagh ibn Ali Al-Heravi* wrote the most important Persian herbal pharmacopoeia, which is known as *Al-Abniyah An Haghayegh Al-Adwiyah*. It is the first prose text in the Persian language (357-366A.H./968-977AD). He described 585 medicines from Greek, Syrian, Iranian, Arabic, and Indian sources. This book also has a scientifically interesting chapter about advanced medicines.[11]

One of the important pharmacological books of that time was *Al-Saydaleh* (Pharmacology) of *Birooni.* He used Babylonian, Greek, Syrian, Indian and Arabic sources in his masterpiece. Birooni also used some ancient Iranian books which no longer survive. *Al-Saydaleh* is not only a valuable masterpiece of the period, but also an old masterpiece of Iranian pharmacology.[11]

Toxicology science

Toxicology is another part of pharmacology and many books and essays are compiled about it. Poison and toxicology science have a long background. Indians have precise texts about poisons and Iranians, like Indians, were eager to find different ways for making poisons. As we see in stories like *The Thousand and One Nights*, powerful men like physicians tried to learn about different toxins and poisons.[11] Aristotle warned Alexander about gifts from Indian Rajahs because there was a girl who had grown up with poison and had a snake's nature.[15] In fact toxicology, like some other branches of pharmacology, is deeply rooted in Indian sources. Indian medicine generally includes essays and texts about poisonous herbs, toxins and antidotes. Most physicians and people of India were knowledgeable about toxicology.

In old medicine, we have a word 'Mithridatism' which means that people try to use poison; they increase the dose step by step to make it harmless for their body. So, after that no poison can affect them. This word comes from *Mehrdad*, king of Pentus land, who reigned from 123 to 63 BC. He tried to use poison and increase its dose step by step, because he was afraid of Roman foes.[15] After that, no poison affected him. He was always searching for science and perfection and was familiar with most of the languages of his time. He hated Romans; however, he lost the war with them. Then he tried to commit suicide with poisons, but they no longer affected him, so he asked one of his soldiers to kill him by dagger. He was the world's first immunologist. Thereafter, Galen made a theriac and named it 'Theriakos Mithridatus'.[15]

Poison and its remedial effects were used in Indian, Roman and Iranian courts. Therefore, scientists tried to find anti-poison and anti-toxic remedies. Galen, Dioscorides and Ibn Vahshieh have books on toxins. Two valuable books in this field were *Toxins* by Jābir ibn Hayyān (Geber) and *Toxins* by Avicenna. We can understand the close relationship between pharmacology and the concealed character of remedies, because famous writers had essays on the subject.[7] Manke, the Indian physician, also translated *Kitab Al-Somum va Al-Teriagh Shanagh* into Pahlavi in Yahya ibn Khaled Barmaki's period and then Abbas ibn Saeed Johari translated it into Arabic for Mamoun the Abbasid Caliph.[25]

The science of sedative and analgesic drugs

The use of analgesics and sedatives dates back to ancient times. *Shahdanj* (*Cannabis sativa*) was used before and after the emergence of Islam.[26] Bang (*Hyoscyamus niger*) is also known as a narcotic drug and is a forbidden substance for abortion. In some books, Bang is wrongly called Showkaran (*Conium maculatum*) or Bazrolbanj (*Hyoscyamus* spp.)[26] Another rival of Bang is Kokenar or Opium (*Papaver somniferum*). Opium or theriac has been used since ancient times. It is originally a Greek word meaning antidote. Professor Pourdavood in *Hormoznameh* mentioned opium as the persecutory agent of the devil. This drug came to Iran in the first century A.H., reached India in the second century A.H., and two centuries later it was transferred to China.[26]

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The important point is that Greek physicians used theriac or opium as a medicine and knew of its harm in the third century BC. Although opium has been used as an analgesic everywhere, it has destroyed the life of thousands of people. According to ancient sources, theriac was not smoked but eaten; indeed, after the discovery of America and production of tobacco, theriac and bang were smoked.[26]

Another historic drug is Hashish (*Cannabis sativa*). Nowadays, hashish is used in all Islamic countries from Morocco to India. We understand that it reached Iran in the 13th century AD according to some poets like Hafez and Mawlawi (Rumi) that mentioned it in their poetry.[27] However, the stigma of hashish at that period was because of its use by a group of Muslims (*Hassan Sabbah* and his followers) who were familiar with hashish's features. Leaders of Nizari Ismailis used hashish to kill and threaten their enemies. They also gave it to their own 'devotee' soldiers to maintain their ignorance.[27] So, followers of *Nazaryeh* were called '*Hashishieh'* or '*Hashshashin*' from 6th century A.H in Syria. This is the name that was brought to Europe by Crusaders as the general name of Ismailis.[26]

At the time of Hassan Sabbāh (1050-1124 AD), Alamūt was one of the main centres for pharmacology and growing medicinal plants. His agents in this city were busy in growing medicinal plants, making traditional drugs and selling them, so they were called *Hashshashin* (pharmacists). He was selling drugs in Alamūt at the lowest price and always aimed to help indigent patients.[28]

In addition to Hashish, *Banj* was named as a toxin in Muslims' medical books after the 4th century A.H. Geber in his book *Al-Somum* (toxins) also mentioned Banj as a sedative drug. Moreover, Abu Mansour Movaffagh ibn Ali Al-Heravi, the ancient writer of pharmacological and medical books mentioned Shahdanj (*Cannabis sativa*) as an analgesic for headache and earache in his book *Al-Abniyah An Haghayegh Al-Adwiyah*. Other Islamic writers mentioned *Shahdanj* or its Arabic name *Ghonab* as an analgesic substance.[26]

Conclusion

Medicine and pharmacy developed more than other sciences in the Abbasid period. Other branches related to pharmacology, such as pharmaceutics, toxicology, production of sedative and narcotic drugs, and publication of herbal books and pharmacopeias, were important.

The experiences of other civilisations helped Muslims to progress in this field. Iranian, Egyptian, Greek and Indian civilisations transferred their ancient experiences to Islamic civilisation.

Medical sciences had such a significant importance that the Caliph ordered the knowledge of dealers of medicine to be examined to make this as scientific as possible. Development of science at that period was the beginning of research. After the Renaissance, chemical medicine was replaced with active ingredients from natural medicines. But nowadays there is a great tendency to use alternative medicine to treat resistant diseases. We hope traditional medicine has the potential to improve alternative medications and suggest new approaches to medicine.

Conflict of interest

Nothing to declare.

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1815 and the Pharmaceutical Apothecaries

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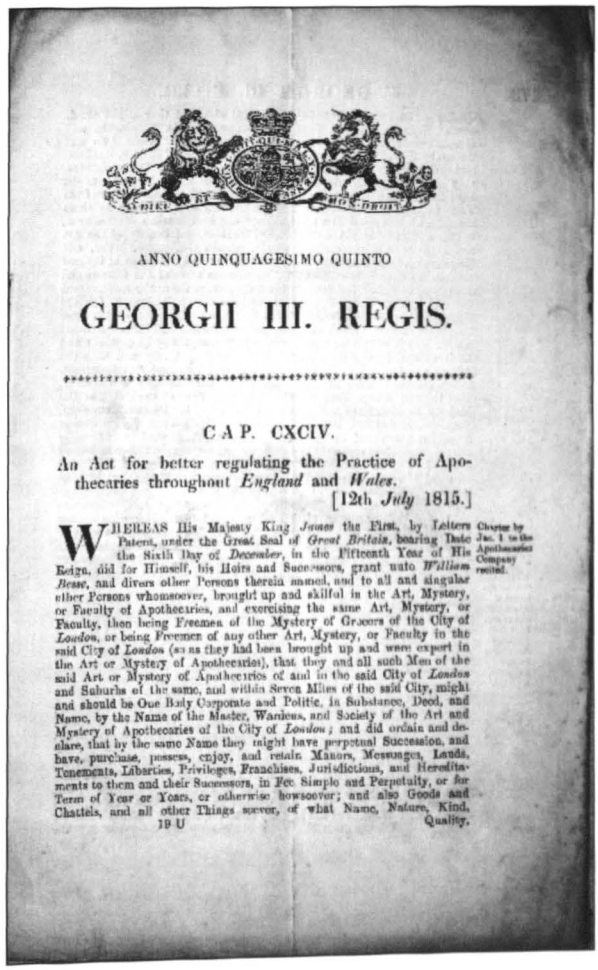
2015 marks the 200th Anniversary of the passing of the Apothecaries Act, an Act which changed the landscape of medical education and in many ways led to the formation of what is now the Royal Pharmaceutical Society. Using a number of secondary sources along with some new primary source material, this paper is intended to give some insight into the influence of the 1815 Apothecaries Act, and into the contribution that some members of the Society of Apothecaries made to the development of the Pharmaceutical Society.

SWF Holloway in his 1991 *Political and Social History of the Royal Pharmaceutical Society of Great Britain*[1] describes in some detail the medical and pharmaceutical landscape of late 18th and early 19th century Britain. At the start of the 18th century, apothecaries had their place as the purveyors of



ANNO QUINQUAGESIMO QUINTO

GEORGII III. REGIS.

CAP. CXCIV.

An Act for better regulating the Practice of Apothecaries throughout *England* and *Wales*.
[12th *July* 1815.]

Charter by Jac. I. to the Apothecaries Company recited.

WHEREAS His Majesty King *James* the First, by Letters Patent, under the Great Seal of *Great Britain*, bearing Date the Sixth Day of *December*, in the Fifteenth Year of His Reign, did for Himself, his Heirs and Successors, grant unto *William Rose*, and divers other Persons therein named, and to all and singular other Persons whomsoever, brought up and skilful in the Art, Mystery, or Faculty of Apothecaries, and exercising the same Art, Mystery, or Faculty, then being Freemen of the Mystery of Grocers of the City of *London*, or being Freemen of any other Art, Mystery, or Faculty in the said City of *London* (so as they had been brought up and were expert in the Art or Mystery of Apothecaries), that they and all such Men of the said Art or Mystery of Apothecaries of and in the said City of *London* and Suburbs of the same, and within Seven Miles of the said City, might and should be One Body Corporate and Politic, in Substance, Deed, and Name, by the Name of the Master, Wardens, and Society of the Art and Mystery of Apothecaries of the City of *London*; and did ordain and declare, that by the same Name they might have perpetual Succession, and have, purchase, possess, enjoy, and retain Manors, Messuages, Lands, Tenements, Liberties, Privileges, Franchises, Jurisdictions, and Hereditaments to them and their Successors, in Fee Simple and Perpetuity, or for Term of Year or Years, or otherwise howsoever; and also Goods and Chattels, and all other Things soever, of what Name, Nature, Kind, Quality,

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Figure 1. The Apothecaries Act 1815. An Act for better regulating the Practice of Apothecaries in England and Wales.

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medicines and were one of the three pillars of the medical profession along with the physicians and the surgeons. However, the 1704 Rose case somewhat changed the landscape by allowing apothecaries to prescribe, if not to charge for advice, a move that had long term unforeseen and unintended consequences. Penelope Hunting's 1998 History of the Society of Apothecaries[2] describes how the rising social status of those apprenticed to apothecaries, and the support by apothecaries of such bodies as the Friendly Medical Society and the Medical Society of London, consolidated the ascendance of medically practising apothecaries to the extent that pharmaceutically practising apothecaries were to a degree excluded from the Livery (that is the higher grades) of the Society of Apothecaries after 1774[3]. With many apothecaries therefore abandoning compounding and dispensing for medical practice, the need for a class of practitioner who could take on that role began to be filled by the rising numbers of chemists and druggists, not only in London, where, despite not having their own guild, they were legally tolerated from 1712, but also throughout the country.

Chemists and Druggists

The increasing competition from the chemists and druggists was irksome to many apothecaries who saw them as quacks and charlatans. Despite the fact that the apothecaries were increasingly medical men and expensive, they resented the loss of their retail trade to the chemists and druggists, and started to campaign against their encroachments and to call for regulation. Various pressure groups emerged and amid some dissension, an Apothecaries Act to regulate the emerging medical profession was passed in Parliament by one vote in 1815. Crucially however, while setting a mechanism to examine new entrants to the profession of apothecary and award them a licence from the Society of Apothecaries, in a final concession, the scope of the Act specifically excluded the chemists and druggists from its provisions, allowing them to continue and to prosper unregulated.[4]

The 1815 Apothecaries Act hence consolidated the position and education of the apothecary as a medical man with a role in diagnosis and prescribing, and who might also, by the addition of a qualification from the College of Surgeons, be truly seen as a General Practitioner. The gap in the market for retailers of medicines thus inevitably created was filled by prominent chemists such as William Allen and Jacob Bell, Bell in particular being a noted opponent of the Society of Apothecaries. It is often considered that with rising numbers, the chemists and druggists came to dominate the professional and political agenda. However, in an early article in *Pharmaceutical Transactions*, perhaps authored by Bell himself, on the definition of a Chemist and Druggist, it states

> there are a considerable number of chemists and druggists possessed themselves of the Licence of the Society of Apothecaries as a precaution.[5]

This raises the question of how much did those qualified as apothecaries really contribute to the rise of the pharmaceutical chemist and of the Pharmaceutical Society?

Founding members of the Pharmaceutical Society

If a 'considerable number' of chemists and druggists held the Licence of the Society of Apothecaries (the LSA), one starting point to identify them is the list of chemists and druggists who attended the public meeting held at the Crown and Anchor Tavern in 1841, where the resolution to found the Pharmaceutical Society was passed. A further reference source is the list of those Founder members of the Pharmaceutical Society who were London based.[6] Such lists can be cross-referenced with the lists of those persons who gained the LSA between 1815 and 1840 and compared with general membership lists at the Society of Apothecaries. Such comparison identifies a number of Pharmaceutical Society members who were also members or Licentiates of the Society of Apothecaries.

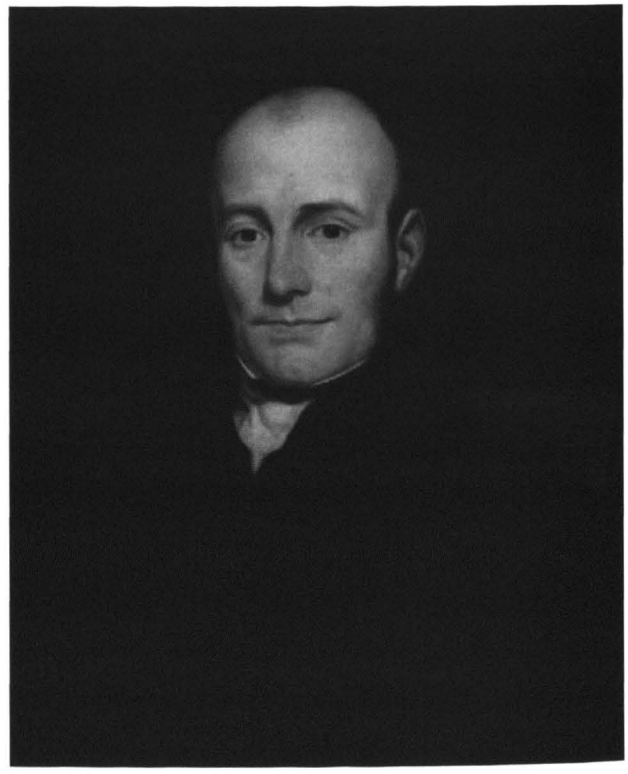

Figure 2. Charles James Payne

Perhaps one of the best known of pharmacist apothecaries is Charles James Payne, first Vice President and second President of the then Pharmaceutical Society of Great Britain. A previously published article[7] has outlined his career. Born in 1794 in the house of his grandfather, also an apothecary, he was apprenticed to an apothecary by the name of Burkitt in Fleet Street. On completing his indentures, he took up his Freedom of the Society of

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Figure 3. John Savory.

Apothecaries in 1815, and so just avoided having to take the LSA. After becoming free he worked for a Mr Winstanly in Poultry, but in May 1817 he was able to open his own shop, a pharmacy, in St Martin's Lane where he remained for the rest of his life. In political terms, Payne's importance grew in the 1820s and 30s, and he became prominent is the movement to close shops on Sundays. However it was in the uproar over medical reform that culminated in the famous Crown and Anchor meeting of 1841 that saw Payne's eloquence lead him to be elected Vice President of the nascent Pharmaceutical Society of Great Britain to Willam Allen's President. On Allen's death in 1843, Payne became the second President of the Society. As a clear advocate for pharmacy practice, at least one report stated that he

> could not be said to practice as an apothecary, having a decided dislike to the profession.[8]

However, his route to pharmacy practice had been via membership of the Society of Apothecaries, showing that at least some of those at the very top of the new profession had also arrived there as refugees from the rapidly medicalising Apothecaries' Hall.

Payne, like Allen before him, was soon struck down with an illness from which he subsequently died, and stepping down as the Pharmaceutical Society's President in 1844, he was succeeded by the third President, another apothecary, John Savory.

Savory had been apprenticed in the family business of Savory and Moore to Thomas Moore, an apothecary who had been admitted to the Society of Apothecaries as a Yeoman in 1794. Since he was already practising, Moore himself would not have needed to take the LSA but Savory trained under his supervision at the family business in Bond Street, and took the LSA examination in 1825. The same year Savory also became a yeoman of the Society of Apothecaries as Moore had before him. It is worth noting here the distinction that the Society of Apothecaries was now an examining and award granting body and that most new holders of the LSA did not become yeoman or liveryman members. Savory however did become so and soon after went to Paris to study at the School of Pharmacy there, returning to the Bond Street business after a three-year stay. He remained a member of the Society of Apothecaries until at least the late 1850s having been advanced to the Livery in 1854, despite not practising medicine.

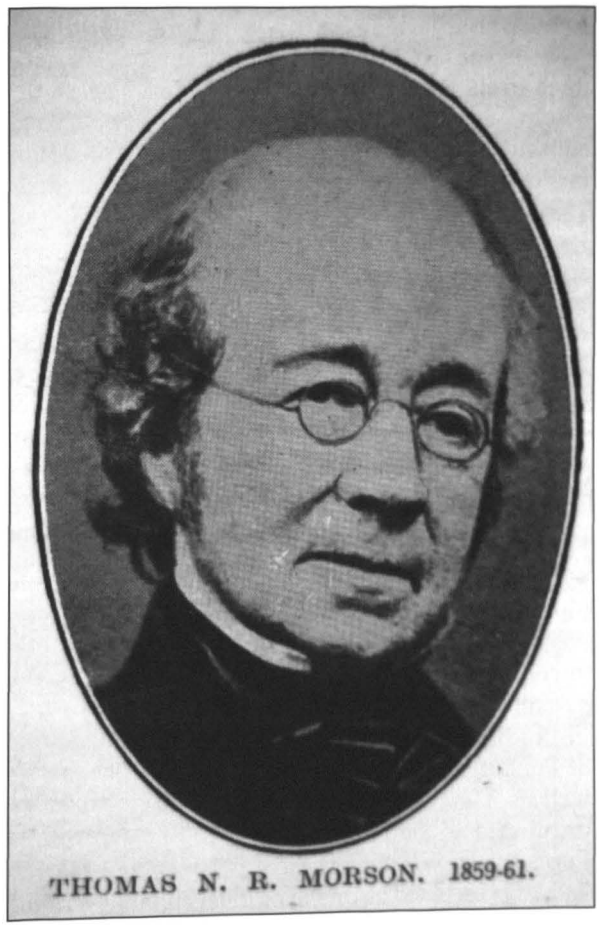

Figure 4. Thomas NR Morson.

President of the Pharmaceutical Society until 1848, Savory in his turn was succeeded by Thomas Morson who thus became the fourth President. Morson was apprenticed in 1814 to Charles Dunn, a surgeon-apothecary at 65 Fleet Market. Dunn died while

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Morson was still apprenticed, and Dunn's practice and his apprentice were taken over by Henry Morley. Morley was very young himself and had only just qualified MRCS. Morson, however, on completing his apprenticeship and deciding he preferred chemistry, like Savory, went to Paris to continue his studies. On returning in 1821, he went back to Morley's old business at 65 Fleet Market where, presumably practising as a chemist and druggist, he succeeded his mentor who continued to practise medicine.[9] Morson moved rapidly into manufacturing, particularly in that of vegetable drugs, later expanding into a vast range of chemical entities and developing the firm of Thomas Morson and Son, now incorporated into MSD. Morson's career therefore also started off as an apprentice to an apothecary, although there is no record at Apothecaries' Hall of Morson actually taking the LSA. Morson served a second term as President of the Pharmaceutical Society in 1859-61 while by an unusual juxtaposition, his former apprentice master, Morley, as a medical practitioner, went on to be Master of the Society of Apothecaries in 1870.

In Payne, Savory and Morson therefore we have three examples of influential early members of the newly created Pharmaceutical Society having educational backgrounds, apprenticeships or examinations involving the Society of Apothecaries. Taking this theme further and comparing the lists of Founder members of the Pharmaceutical Society against the lists of those who held the LSA, we find several more Licentiates or members of the Society of Apothecaries amongst the early members of the Pharmaceutical Society, although perhaps fewer than might have been suggested by the statements in *Transactions*. A comparison of just those Founder Members of the Pharmaceutical Society who were based in London, against the LSA pass lists at the Society of Apothecaries shows that those who also held the LSA included John Freeman of Blackfriars Road and John Stirling of Whitechapel.[10] Furthermore some apothecaries who joined the new Pharmaceutical Society in 1841 had qualified like Payne as apothecaries under the old apprenticeship system prior to the passing of the Apothecaries Act in 1815. Those included Edward Newnham Winstanley of Poultry, who is recorded in the Livery in 1848, as well as Thomas Moore of Bond Street, previously mentioned as the apprentice master of John Savory. Furthermore Winstanley, Payne, Savory and Morson had all been listed as on the original committee of the Pharmaceutical Society formed at the Crown and Anchor Tavern meeting on 15th April 1841.

It can therefore be shown that in London there were a number of pharmacists and particularly some influential ones, who came from a background with the Society of Apothecaries. If the statement in *Trancactions* is to be believed it is likely there were also a number in the provincial lists who were connected with the Society of Apothecaries in some way.

Haselar papers

At the Society of Apothecaries some new primary sources, a set of family documents, have recently come into our possession and which serve as further illustration. Through the generous gift of Miss Elizabeth Turner we recently acquired at Apothecaries' Hall the indentures of two of her ancestors, Albert and Alexander Haselar. The indentures are in effect the contract of employment of these two young men, and in both instances record their apprenticeships to their uncle, Charles Churchill Haselar.

Charles Haselar was probably born in Westminster in 1782,[11] and is recorded as himself having gained his basic qualification, the Freedom of the Society of Apothecaries, by servitude, that is apprenticeship, on December 3rd 1805.[12] The records unfortunately do not record the name of his apprentice master, but he would have been articled around the beginning of the 19th century. The documents show that in 1814 Charles Churchill Haselar, who at that time was an apothecary in Lenham near Cranbook in Kent, took as his apprentice Albert Edward Haselar, his brother's son, the indentures being signed on 2nd August.[13] Three years later, in 1817, Charles also took on Alexander Haselar, younger brother to Albert, who was likewise indentured, this time on 2nd September 1817. In due course Albert Edward Haselar took the then new LSA examination upon finishing his apprenticeship, and became a member of the Society of Apothecaries, as did his brother.

Amongst the new documents acquired however, is evidence that a member of the family made a number of genealogical enquiries around 1895 to The Society of Apothecaries, The Royal College of Physicians, the Pharmaceutical Society and to a Haselars Pharmacy in Kent. In a reply, the letterhead of Haselar's pharmacy purports to show it to have been founded in 1785. Further enquiries of the Pharmaceutical Society confirm that an Albert Haselar of Cranbrook was listed as a member of the Pharmaceutical Society as early as 1842, again in 1851 and between 1856 and 1868. After the passing of the 1868 Pharmacy Act, Albert Haselar appears in the registers from 1869 until his death two years later in 1871.[14] This latter date seems to be confirmed by the surviving correspondence as well as from other sources.[15] Last revised in 1935, the family documents appear to show that this Albert was Charles Haselar's own son, born in 1808, (and not to be confused with Albert Edward one of the two nephews who were apprenticed) and who it seems became a pharmaceutical chemist rather than being apprenticed to his father as an apothecary as his cousins had done. Family and other enquiries reveal that Albert ran a pharmacy in Stone Street, Cranbrook in Kent up until his death in 1871.[16,17]

Of interest is the early date for Albert Haselar's pharmacy. Was this pharmacy previously the apothecary's shop run by his father Charles and perhaps founded by a forbear in 1785? The Society of

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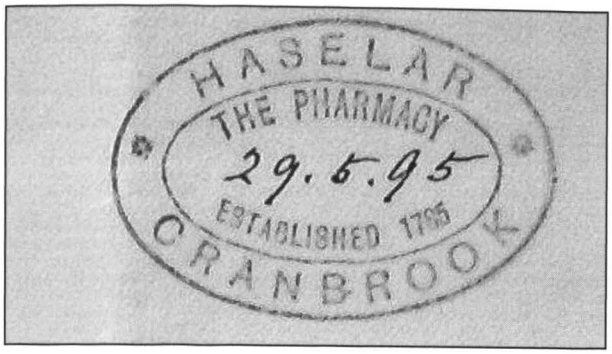

Figure 5. Haselar pharmacy stamp.

Apothecary records show Charles Haselar as being in practice in Cranbrook in 1829 but there are no earlier members of the Haselar family in the Society of Apothecaries archives. Since Charles was a Liveryman of the Society of Apothecaries, it must be assumed he would have been practising as a medically inclined apothecary and that he trained both his nephews, Albert Edward and Alexander, in order for them to gain the then new Licence of the Society of Apothecaries as created by the passage of the 1815 Act. However, since his own son Albert trained as a chemist and druggist and then also practised in Cranbrook, this may be an example of an apothecaries' business subsequently metamorphosing into a chemist and druggist, with its owner in allegiance to the Pharmaceutical Society rather than the Society of Apothecaries. If this conclusion is correct, it is a provincial example of the fluidity of the practice of medicine and pharmacy at that time and of the closeness of the calling of apothecary to that of chemist and druggist.

Similar provincial examples are reported by Holloway and so the Haselars were undoubtedly not alone. Indeed many provincial apothecaries may have taken the LSA after 1815 but found it more profitable, or, like Morson and Payne, simply more congenial, to practise pharmacy. Perhaps however, it is hardly surprising that this group of better educated chemists and druggists, who held the LSA or had connections with the Apothecaries, were a significant part of the driving force behind the formation of the Pharmaceutical Society. After the 1815 Act, the Society of Apothecaries, although it examined in pharmacy, had the wider interest in training for General Practice. By contrast, the new Pharmaceutical Society had education for chemists and druggists as its top priority. Therefore those who wished to restrict their practice to pharmacy found that now, the Society of Apothecaries neither promoted suitable education nor represented their interests, nor indeed was interested in them unless it was to restrict their activities. Hence, although the new men making up the chemists and druggists may well have been driving the numbers in the formation of the Pharmaceutical Society, we perhaps need to recognise that there was a significant input at the highest levels from a noteworthy cohort of well educated pharmaceutical chemists and apothecaries with a background or qualification from the Society of Apothecaries, who nevertheless sought a new body to provide them with education and to represent their interests. The new Pharmaceutical Society was designed to do just that. It may well have been therefore that without the impetus of the Apothecaries Act of 1815, the Pharmaceutical Society of 1841 might never have come into being.

Acknowledgements

John Betts, Keeper of the Museum Collections, for access to the RPS archives.

Presented to the British Society for the History of Pharmacy Annual Spring Conference, Sunderland, 28th March 2015.

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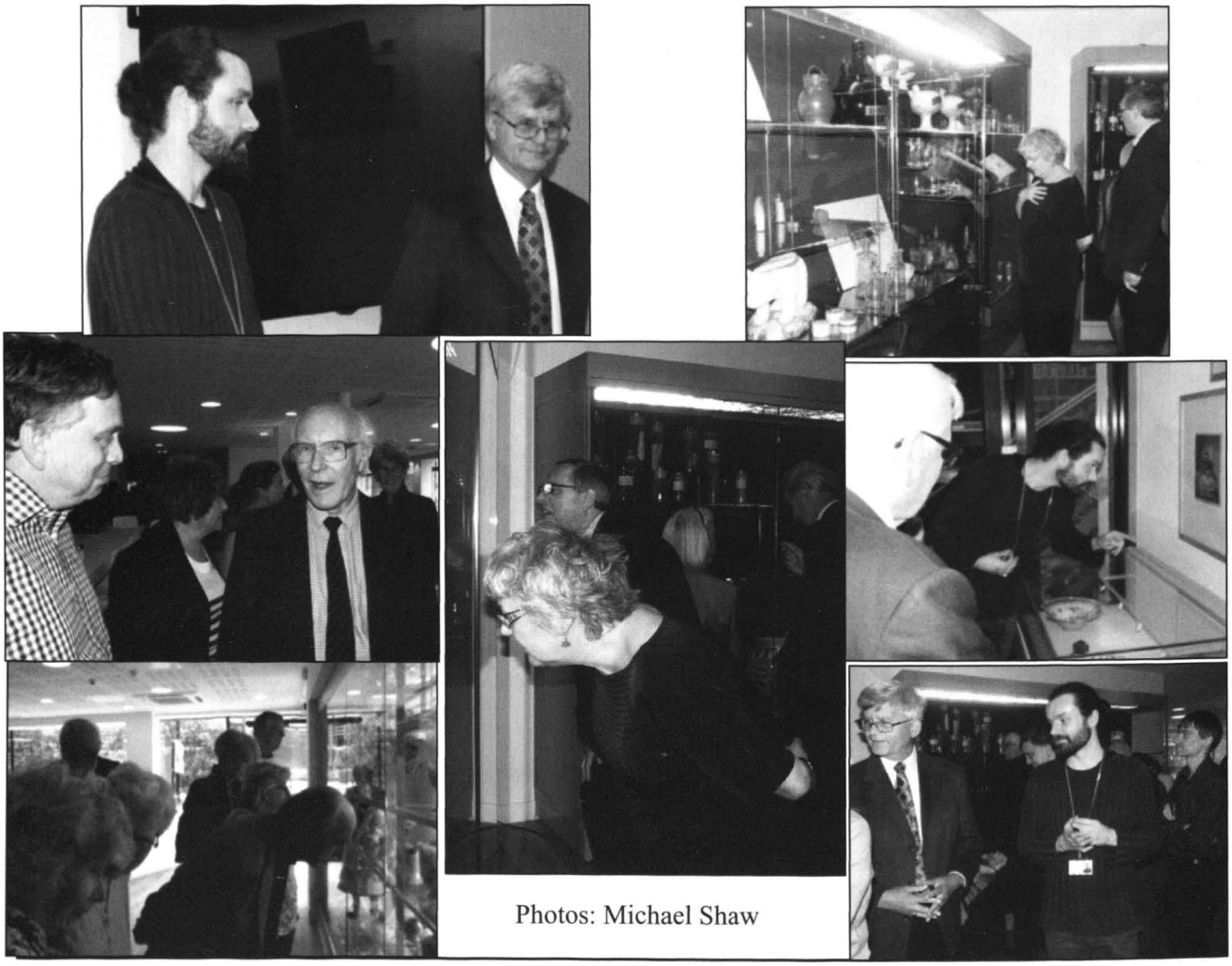
The new RPS Headquarters and Museum

On 27 July the BSHP held a joint meeting with the Friends of the Archives of the Society of Apothecaries at the new building of the Royal Pharmaceutical Society at 66-72 East Smithfield, London E1W 1AW. Members were able to see the new displays and given a guided tour of the new building, accessible from Tower Hill and Tower Gateway stations.

John Betts, Keeper of Collections at the RPS Museum gave a short introduction to the current displays. The new RPS Museum displays will cover the development of British Pharmacy from the 1500s to the present day:

- Pharmacy in the 1500s and 1600s, including Apothecaries
- Georgian Pharmacy
- The History of the Royal Pharmaceutical Society
- Victorian Pharmacy, including equipment pharmacists used to make medicines.
- The development of treatments for pain and infection.
- Poisons as medicines
- 20th century pharmacy
- Landmark Drugs and how they work in the body

All of the displays are located together on the ground floor, including display cases devoted the Society's English Delftware and foreign drug jars and English and foreign bell metal mortars. The museum will be open Monday to Friday, 9am-5pm. Admission is free and there is disabled access.



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British Society for the History of Pharmacy

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The British Society for the History of Pharmacy was formed in 1967 under the aegis of the Pharmaceutical Society of Great Britain, having originated from its History of Pharmacy Committee.

BSHP seeks to act as a focus for the development of all areas of the history of Pharmacy, from the works of the ancient apothecary to today's ever changing role of the community, hospital, wholesale or industrial pharmacist. Membership is open to all interested in the aims of BSHP.

Aims

Promotion of historical studies related to pharmacy.
Advancement of knowledge and propagation of understanding of the history of pharmacy.
Publication of the research work of pharmaceutical historians.
Preservation of pharmaceutical artefacts and historic pharmacies.
Support for the work of relevant museums and offering advice on establishment of other pharmaceutical exhibits and on the preservation of pharmacies.
Co-operation with related professions and local historians on medico-pharmaceutical topics of mutual interest.

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The *Pharmaceutical Historian* has been published since 1967, at first intermittently, but on a regular quarterly basis from 1972. Issues generally comprise 16 or 20 pages and cover.
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Papers, short communications and letters in English on any aspect of the history of pharmacy are welcome and should be sent, preferably as an email attachment to *ainley.wade@easynet.co.uk* or to the address above. Any illustrations are converted to monochrome for printing. Further details of requirements can be found on the website *www.bshp.org* under Publications.

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Contents

Diary

Please note that evening meetings will be held at the RPS, 66 East Smithfield, London E1W 1AW on Mondays 5.30 pm, starting with refreshments at 5.00 pm, unless otherwise stated.

Monday 9 February 2016

'Silas Burroughs: the forgotten partner' by Julia Sheppard, formerly Head of Special Collections and Research at the Wellcome Library, at RPS, 66 East Smithfield, London E1W 1AW, 5.00 for 5.30.

Monday 23 May 2016

'Henry Wellcome, pharmacist' by Ross Macfarlane, Research Engagement Officer, Wellcome Library, at RPS, 66 East Smithfield, London E1W 1AW, 5.00 for 5.30

Monday 10 October 2016

'Expedition medicine' (provisional title) by Dr Henry Guly at RPS, 66 East Smithfield, London E1W 1AW, 5.00 for 5.30

Women pharmacists demand the vote

Briony Hudson has contributed a blog on the involvement of women pharmacists in the suffrage movement on the Wellcome Institute website at http://blog.wellcomelibrary.org/2015/10/women-pharmacists-demand-the-vote/

BSHP has its own **Facebook** page. 'Like' us to share information on events, news items, resources, research and other pharmacy history topics from BSHP and related organisations.

BSHP Annual Spring Conference 2016

will be held **1-3 April 2016 at** Best Western Plus **Reading Moat House Hotel,** Mill Lane, Sindlesham, Wokingham, Berks RG41 5DG

The overall theme of the weekend is ***Education*** and speakers on Saturday will deal with the history of pharmaceutical education in various countries and institutions.

On Sunday, after the AGM, we will hold an audience participation session based on your memories.

Was there a charismatic tutor or pharmacist mentor during your early career, or some aspect of the undergraduate syllabus, which made you into a better pharmacist over and above the information conveyed?

Are the same stimuli still available to young pharmacists today and if not how can we make sure the same effect is produced within today's high-powered academic training?

Three members will give a short presentation on their experiences to stimulate discussion and then it will be over to you. We will record the session and try and work it up into an article for the Historian but it would help if you bring your ideas on paper to help with the interpretation of the tape.

Shirley Ellis

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Welshman Sir William Vaughan (1575-1641) and his Popular Health Books: Observations, theory and therapeutic effectiveness

John K. Crellin

Honorary Research Professor, Memorial University, Canada and Totnes, Devon

Sir William Vaughan of Carmarthenshire (1575-1641), Master of Arts and Doctor of Civil Laws from Oxford University, poet in Latin and English, colonial promoter, and author of many books including on health care, is not mentioned in Alun Withey's recent book on health and medicine in Wales from 1600 to 1750.[1] There are perhaps good reasons to omit this 'worthy of Wales'.[2] English-language writings such as Vaughan's could have had little direct impact in Wales given the high illiteracy and about 90 per cent of the population speaking only Welsh;[3] on the other hand, as with all vernacular medical books at the time, one can assume the upper classes diffused some of the advice to friends, neighbours and others.[4]

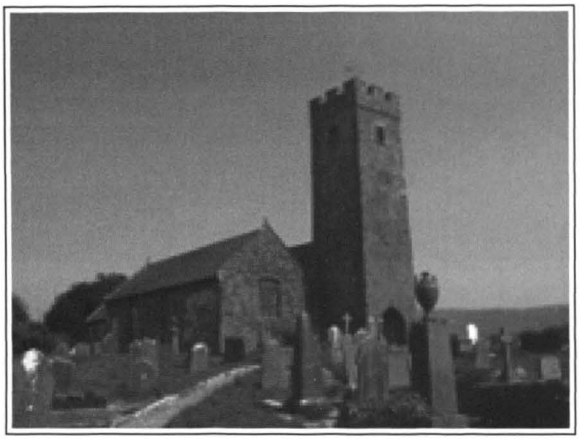

Figure 1. St Cyndeyrn's Anglican Church, Llangendeirne, Carmarthenshire where Vaughan is buried (grave unmarked).[5]

The nature of Vaughan's advice in his *Directions for Health*, *The Newlanders Cure*, and other books (no relevant manuscript material has been located) is the focus of this article. What types of evidence shaped his choice of treatment regimens that straddled both 'official' and home medicine?[6] It is a question to be asked of other authors when considering the scope of therapeutic evidence during the late sixteenth to early seventeenth centuries.

Non-physicians, like Vaughan, defended their lack of formal medical training. After all, they faced criticism from physicians with university MDs who stressed the superiority of their scholarly knowledge over the oral/family traditions within home medicine.[7] One physician, who told a patient that Vaughan's prognostic was 'vain and frivolous,' likely felt all lay authors added another negative feature to the medical market at the time with its blurred boundaries between MD physicians, surgeons, apothecaries (i.e., druggists who also practised medicine), itinerant quacks, midwives and lay healers.[8]

Vaughan himself acknowledged this confusing scene, maybe adding to the acrimony that characterised much of it. While he respected 'honest' physicians – after all, two editions of his *Directions for Health* were marketed as 'Approved' remedies from the best physicians – he had harsh words about many practitioners in an age he saw as 'full of deceit'.[9] For instance, he told of 'rich people, chiefely ladies, [who] looke somewhat paler than they were wont, but their physitians, which commonly are cheating Mountebanckes, doe make them beleeve, that they are sicke of a consumption.[10] There were, too, 'butchering Surgeons and bloud-sucking Empiricks';[11] 'Druggists [who] sinne … against heavon and earth, by selling glozing blanchments of Italian and Jewish tromperies'.[12] And, in 1630, Vaughan alluded to greed when writing that, if he suggested more medicines, physicians would 'indite [him] for intrusion into their profession' although he felt they would be more 'offended [with] this Dietary Cure'.[13]

Vaughan's Authority

Vaughan offered hints, some commonplace among lay authors, as to why he forayed into 'this kinde of studie' on 'how every man should keepe his body and minde in health: and sicke, how he may safely restore it himselfe.'[14] For instance, aside from his obvious love of authorship reflected in his lifetime of publishing, Vaughan noticed his own poor health as a youth, once writing that his health was 'of more consequence' to him than his 'clientes case'. Evident, too, was his sense of public service linked to concerns for those in remote places where 'honest physicians are scarce'; for the poor in Wales and elsewhere; and for the health of sailors on long voyages. Further, he took special interest in the effects of different climes on health.[15] But, more importantly, Vaughan needed to reassure readers of his authority in health matters. Relevant – even if implicit rather than explicit – was his positive writing style that hinted at extensive knowledge, personal experiences, and appreciation of traditional/local information, along with his acceptance of such recognised medical authorities as Hippocrates and Galen. All these factors, considered below, lead to my suggestions about Vaughan's guiding principles behind his choice of remedies.

Personal experiences

Assessing, at any time, the nature of evidence employed in everyday health care is never easy due to different levels of experience among practitioners or members of a family. In Vaughan's time, observations were key 'evidence' behind generalisations about the value of a therapy. Early on, Vaughan wrote that he did not need to explain a particular regimen, since 'that which is openly seene with eyes, need no proofes'.[16] Yet he was silent on how many observations/experiences were considered necessary to generalise despite recognising the value of repetition. For example: 'our late criticks collect by experience, that in [every] seaventh year more unnaturall ill humours are engendred' than can be handled by the body.[17]

Vaughan also occasionally used the term 'experimented' to justify a treatment, referring either to

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putting to the test (often trial and error), or comparing patients who had either received or not received a medicine. For instance, he advocated turnips ('a singular remedy') for scurvy after the efforts of 'Mr. John Guy of [Bristol], a judicious Gentleman, and a worthy friend of mine, [who] experimented in the Newfound-land' and showed that those who had eaten the vegetable fared better than a 'control' group.[18] But Vaughan's apparent commitment to empiricism was muddied when he inextricably intertwined observation and theory, for instance, 'Because [tobacco] according to the nature thereof, hot and dry, doth draw unto it such watrish humours as otherwhiles offend the body,[it relieves] 'the megrim [a type of headache and], the tooth-ache.'[19] Thus the *post hoc ergo propter hoc* fallacy cannot be discounted, a central issue in long-standing, confusing debates over empiricism/experience and rationalism in therapy.

Unfortunately, the actual level of Vaughan's medical experience is difficult to determine, despite the well synthesised detail in his confident writing, and the reasonable assumption that, at times, he practised medicine charitably because of his medical knowledge, his social position in Welsh society, and his concerns with Welsh economic plight ('thousands yearly doe perish for want of reliefe.')[20] Aside from an occasional 'I commend' or 'I advise', only a few clear hints of actual practice are evident. (i) 'I have found by experience [that Paracelsus his stiptick playster] heale any wound, whether it be olde or greene, sooner in one weeke then any other in a moneth.' (ii) 'I have tryed that three parts of Sugar-Candy and the fourth part of Enula Campans and Licoras, being made to powder is an excellent remedy [to cure the cough]'. (iii) 'For the richer sort [with one type of collicke], I prescribe this singular receipt; take Venice Treacle or Mithridate with a few beaten cloves dissolved or mulled in cup of wine'. And (iv) once, a reference to 'my patients', although, as part of rhyming advice, maybe poetic licence.[21]

Added to these are a few more indirect hints, though still not pointing to widespread experience: (i) managing his own early ill-health (he once noted that it might have become 'more distempered and crazed, if [he] had trusted others more than [his] owne in-sight'[22]; (ii) a keen eye suggested by recollections from his impressionable European travels (for instance, in Hungary a fiery fever was 'cured onely by salt niter prepared with sulphur');[23] and (iii) the relatively small number of medicines listed, compared with the greater numbers found in many other books, perhaps a sign that he recommended those he knew best.[24]

Local knowledge/tradition

Given the uncertainty over the extent of Vaughan's personal experiences, his references to 'local knowledge' at least added a 'pedigree' of experience considered to be captured in oral traditions. Examples, mostly about maintaining health, are: (i) the healthiness or otherwise of cheeses whereby 'the cunning of the Dairy-Woman is most to be regarded)';[25] (ii) references to local vegetables, e.g., 'Pease eaten greene, with Butter and Pepper, doe cure the jaundise and dropsie';[26] and (iii) herbs that Vaughan saw as God's provision of simple remedies for the 'good huswife or gentlewoman to have alwaies in the gardens;' among many were 'piony and mugwort' for 'difficulty in childe-bearing, and ... provoking of the menstrues'.[28] In support of his confidence in herbs, he cited the longevity of man's biblical parents due to their knowledge of the 'hidden vertues of hearbs and stones [without today's] delicate inventions and multiplied [polypharmaceutical] compounds'.[28]

Also resonating with some readers were proverbs, well-known sayings, and biblical quotations laced into Vaughan's writings. Even if viewed as displays of Vaughan's erudition, they offered notions of common sense or collective knowledge accepted over time. This served as an added element of proof as when he responded, in English plus a Latin saying, to the question, 'What shall a man doe, if the Ayre be eyther too hot, too cold, or too corrupt?' He wrote: 'To depart thence into another place were not amisse: For oftentimes it is seene that sicke folkes doe recover their former health onely by change of ayre; to which agrees that verse: *Mox, procul, et tarde, cede, recede, redi* [Go soon far away, return slowly.']'[29]

Vaughan's medical books: theory

By failing to clarify the extent of his own practice, medical books were seemingly the core of Vaughan's authority. The announcement 'derived from the best physitians as well moderne as auncient', on the title page of *Directions for Health*, dove-tailed with Vaughan's 'chiefest pleasure ever since my childhood,' namely to 'reade more bookes of Phisicke than of any other'.[30] He appreciated doctors for their book learning, perhaps for the same reason physician Juan Huarte noted that the importance of physicians learning from books written by 'reasonable experienced physicians' was to avoid killing 'an infinit number of persons before [a practitioner] could attain to the knowledge of [medicines'] qualities'.[31]

Not surprisingly, Vaughan found inconsistent information though hardly his reason for citing, albeit not consistently, authorities.[32] Classical authors included (a) Hippocrates: the basis of Vaughan's warning that 'to give wine or milke to them that be sicke of agues or head-aches, is to give them poyson' was a Hippocratic aphorism.[33] (b) Galen: for example, 'You must use after the example of Galen, to carry about you a sweet Pomander, and to have alwayes in your chamber some good perfumes'.[34] And (c) Celsus: 'The ancient Physitian Celsus approves: It is better ... to walke abroad in the Sunne, if your head will permit, than in the shade, and in the shade, rather than in the house'.[35]

'Moderne' writers included: 'Marsilius Ficinus, that great physician' who proclaimed the value of honey, when used in diet, as a 'safegard of long life and a trusty buckler against all diseases'; Jean Fernel, who affirmed 'that fasting worketh the like effect as bloud-letting, but more naturally and with no danger;' and Felix Platter, 'that great Professor of Physicke at Basill' describing a case of hypochondria.[36] Hugh Plat, an eclectic Elizabethan, was a

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popular non-physician author quoted by Vaughan in advising on preserving meat and fattening capons.[37]

Vaughan's commitment, supported by much of his reading, to the Galenic theory of disease and treatment, which was generally familiar to the public as the need to rebalance humours to restore health. One thread of Galenic medicine, namely Nature's healing power – often referred to as *vis medicatrix naturae* – attracted Vaughan. This is evident in the importance he attached to the 'non-naturals' as ways to maintain health around which he organised much of his *Directions for Health*. Thus he covered: the environment (air, fire, water); food and drink; evacuations (from blood-letting to sexual activities); habits (sleep, early rising, and exercise); and, motions of the mind (e.g., mirth and jealousy.) When ignored, Vaughan, as did others, preached that ill-health followed: 'He that concerne a good diet [here meaning all the non-naturals], neede no artificial Physicke'.[38]

Moderation in food, drink and lifestyle was Vaughan's constant message throughout the editions of *Directions for Health*. For instance, a 'sparing diet' and fasting (even if this was limited), assisted Nature: 'In Ireland they cure their Agues onely with fasting foure or five dayes, from all kindes of meates, leaving Nature alone to spend out those superfluous humours.'[39]

Moderation was even more evident in Vaughan's *The Newlanders Cure*, a book that, today, attracts much Newfoundland-Welsh interest because of Vaughan's promotion of colonial settlement in Newfoundland. Views exist that the book was a health manual for settlers, but it was hardly practical for the pioneering conditions. In fact, the book was a vehicle to extend two main themes – the roles of diet (food and drink) and of the mind in health and disease – covered in *Directions for Health*, a work he had likely offered to settlers. And, while Newfoundland was to the front of his mind when writing the new book, other factors were seemingly relevant such as his advancing years (preoccupation existed at the time with prolonging life) and his wish to continue serving the 'Publicke Good'.[40]

Given Vaughan's previous attention to diet, it is noteworthy that *The Newlanders Cure* announced two new authorities on diet, namely Luigi Cornaro and Léonard Lessius.[41] Despite both being Catholics – Vaughan had a strong aversion to Catholicism – their works were a revelation to him. (His alliteration of *Newfound Land* and *Newfound Dyet* on the title-page was telling.) In consequence, he promoted an 'admirable Dyet' for which he found further authority in the Bible: 'When I had compared Lessius his observations with Daniels and his three Companions Dyet, and how by reason of their slender fare being but Pulse, they were in better state than those that fed on dainties, I concluded this new found dyet to be acceptable to Gods spirit'.[42] Indeed, for Vaughan, attention to diet added to necessary spiritual purification 'before a man can assume a glorified immortall body in Heaven'.[43]

To soften his fear-mongering statement that 'all our sicknesses proceed from repletion,' Vaughan's salvation was, as expressed by other authors, to follow the 'Golden Meane,' defined as 'Temperance in our Dyet, that is, eating and drinking no more, than the stomacke can well digest'.[44] Among many benefits, as rationalised by Galenic physiology, 'the gout, the dropsie, the asthmaticke passions, the cough, and catarrhs' could, for example, be cured by keeping 'backe all the Humours and watrish spirit, which arise from the stomach to the head'.[45] Although Vaughan recognised a treatment for one person's constitution might not suit another (e.g., the elderly, or labourers who had stomachs like ostriches 'which can digest iron'), he still offered general advice with, for example, suggestions about the amounts of meat and drink.[46]

Equally important for Vaughan was that, besides bodily benefits from his 'new' diet, 'the functions of the Minde' would not be 'hindered nor made obscure by [an] excessive Quantity' of food. This was but one further statement in his long-time concerns with close body-mind relationships that he summarised as: 'the Body is oftentimes turned *Nolens volens*, to serve and obey the mind, as the minde likewise to follow the inclination of the body'.[47]

Comments on Choices of Treatment

Like all practitioners and medical authors, Vaughan faced a vast range of medicines and many complex formulations in an age when polypharmacy remained widespread. What choices did he make and why? What was his evidence? While general recognition existed that a wide range of medicines was necessary to accommodate the diversity of individuals and their ailments, Vaughan's choices drew, as would be expected, upon the characteristics just noted that became his guiding principles.[48] With regard to moderation, when attention to food and drink failed or needed supplementation, he encouraged simple regimens/ remedies to assist nature restore balance. When these failed, maybe due to the severity of the condition, 'artificial physicke' was necessary at times due not only to human foibles, but also because diet as treatment was slow such that a 'diseased party may in the meane time suffocate and perish, like the horse, that starved, while the grasse grew'.[49] Vaughan then often selected 'official' medicines.

Simple medicines. Vaughan's confidence in simple remedies is reflected in his antipathy toward many polypharmaceutical preparations, sometimes because of their doubtful quality. Gluttony, he said, might lead to regimens of 'nauseative and bitter potions' for purging humours from the gut, the liver and the veins that, in turn, would 'weary the strongest Nature'.[50] Elsewhere he wrote: 'It [would be] a work of charitie in our physitians, if herein they would admonish their patients to insist and to imitate the ancient prescriptions of Nature and not to surcharge them with so many monsters of Indian or Arabian mixtures.' Such 'monsters,' instead of rooting out the venomous seeds of sickness, left a 'cankred constitution … ready to harbour new and unheard of

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infirmities, occasioned by the poisonous relickes of their medicines'.[51]

Favouring simple remedies drew on Vaughan's respect for local knowledge and herbs. For gout, as an example, Vaughan proposed applications of 'divers locall medicines, as oyles of Roses, of Mirtilles, of Cammomill, or wild mallowes, of turpentine or such like'.[52] However, just as God heaped diseases on 'man for sinne,' treatment regimens also needed God's helping hand such that Vaughan wrote about preserving a man in a temperate state: 'first by Gods permission, and then by useing weekely either the weight of one scruple of the spirite of the herbe called Rosa solis [sundew] or the essence of Celandine'.[53] An alternative to these two herbal preparations was 'the quintessence of potable gold, wherein pearles are dissolved,' another simple preparation if challenging to prepare, which Vaughan associated with Paracelsus. Later, however, he dismissed the preparation, describing it as the 'vanitie of vanities' or 'our Paracelsians ... beleeve,'strange miracles of their Elixir and Potable Gold' for preserving the body.[54]

Vaughan continued to accept other remedies of the Paracelsian school though he seemingly ignored the theory behind their use. Paracelsus' 'Stiptick Playster' has already been noted. Two others, alternatives to a compound vegetable purgative, were antimonials: (i) 'Pils called Pantemagogon,' and (ii) 'three grains of Stibium [prepared antimony] in a cup of beere steeped and beaten to powder,[taken] every second day for a weeke together'.[55] Stibium was evidently a favourite with Vaughan as an emetic or purge: 'I see none comparable to Stibium ... which I dare boldly commend as a most soveraine and cheape remedy for agues, dropsies, fluxes and distillations unto the poorer sort'.[56] Indeed, this was but one inexpensive, hence relatively simple, medicine Vaughan recommended for the poor.

Vaughan's preference for simple treatments is further illustrated in his overall approach to purgatives that merit notice if only as a key feature in Galenic regimens for all manner of diseases. Perhaps as a result of this, Vaughan was concerned that their frequent usage could be 'most dangerous' through diminishing the vital powers of nature.[57] Further, those taking 'exquisite purgations, and especially Electuraries soluble, shall quickly waxe old and gray-headed'.[58] On the other hand, gentle purges could replace vigorous medicines as 'little and little [they] consume away the cause'.[59]

When a relatively vigorous purgative was required, Vaughan still noted relatively simple preparations of, for example, senna, rhubarb or mechoacan [a kind of jalap]. Vaughan described the latter as a 'sovereign' remedy along with hints of first-hand experience: 'I could wish them that dwell farre from physitians to provide themselves [with] the roote Mechoacan, which comes from the West Indies; the best is white and heavy'.[60] It was just one of a number of New World drugs that entered 'official' medicine during the 1500s and spread into popular advice books.

Whatever the advice on purgatives (and other classes of medicines) uncertainties must have persisted for many readers, even those with experience in looking after families, who merely read Vaughan to compare with or supplement their existing knowhow. As Vaughan made clear, the individuality of patients and their situations had to be negotiated; for instance, 'eight things' when administering purgatives, namely qualities of the drug, time of year, climate of the country, age of patient, their customs, the disease, patient's strength and position of the moon.[61]

Polypharmaceutical preparations. In recognising that not everyone would have even simple herbs to hand, Vaughan indicated they could be obtained from apothecaries, as could the occasional polypharmaceutical preparation he recommended.[62] Even some of the latter were relatively simple such as 'those which the Arabians call the Blessed Pils of Aloes ... compounded of Aloes, Mirrh, and Saffron', which, generally known as Pil Rufi, had a long history as a physician's medicine.[63]

The really complex polypharmaceuticals recommended by Vaughan covered, with some exceptions, well-known products such as 'Treacle' (Venice treacle) and Mithridatium.[64] While omitting these might have been viewed as negligence given the overwhelming authority behind them, Vaughan was positive over their value as preventatives. For instance, (i) to maintain good health 'first by Gods permission, by observing a good diet, & sometimes by using of some treacle, mithridate or such like in the spring time, & Autumne'; (ii) 'I advise all of them [who] make long voyages at sea, not to be unprovided of Treacle'; and (iii) to prevent the infection: 'You must use such Antidotes as resist poyson, to fortifie your fort, which indeed is Treacle, if it be truely made'.[65]

Vaughan's comments on another polypharmaceutical deserve a note for leaving readers to make a judgment whether a better alternative existed to Doctor Stevens Water. This, a distilled aromatic water prepared from twenty or so aromatic ingredients, already had a solid reputation by 1600, one that survived into the eighteenth century and patchily beyond. Vaughan described it as an excellent preservative to prolong life. 'Hot in operation,' he recommended a spoonful once in seven days and added oft-repeated evidence that Doctor Stevens used his water and lived 'one hundred years wanting two.' However, Vaughan informed readers that the Sublimated Wine of Andre Galli, physician to Emperor Charles V, helped Galli 'to live six score and nine yeares without any disease: which I thinke to be better than Doctor Stevens Water'.[66]

Vaughan's remedies and effectiveness

Unfortunately we do not know whether Vaughan, despite his generic use of 'Approved,' had the same confidence in all his suggestions. Unlike many authors of vernacular medical books, he only appended to one treatment the phrase *probatum est*. Its meaning, 'it has been proved' (occasionally shortened to 'proven'), suggested confidence in effectiveness either from experience or from authority.[67] Nevertheless, like other authors, Vaughan sometimes added such descriptions as 'sovereign,' 'singular remedy,' 'wholesome,' and 'excellent preservative,' though, frustratingly, their relative weighting is presently unclear.

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Given the uncertain effectiveness of therapies in Vaughan's time, this account closes on a speculative note, one pertinent to ask of other medical advice books contemporary with Vaughan. During his lifetime a slow shift took place toward more critical appraisal of observations over treatments in line with a growing questioning of Galenism. Leaving aside major attacks such as from the Paracelsian school, hindsight reveals isolated, but cumulative, stepping stones. For instance: (i) reminders of the Empirical school of physicians in classical Greece and Rome that highlighted the value of treatment outcomes on individual patients, rather than theoretical justification;[68] (ii) statements as by Philip Barrough, who, in 1596, indicated that he laced the observations of others with 'experiments of mine own, which by long use & practice I have observed to be true';[69] (iii) the dangers of early, over-enthusiastic observations as when John Cotta indicated that tobacco had initially acquired on its arrival in England, 'high fame and great renowne … as an incomparable jewell of health;' however, Cotta noted that later experience showed this to be unjustified;[70] and (iv) even the attacks by physicians on the errors of mountebanks, empirics, and so on, justifiably emphasised the importance of experiences over time.[71]

From the available evidence, Vaughan was not part of the slow shift toward new appraisals of treatments. He gave no consideration to the quality of, or 'defects of observations' due to inadequate experiences or taking recipes from others on trust.[72] On the other hand, noteworthy are his concerns over polypharmacy as is his emphasis on simple treatments, even while accepting authorities 'auncient and moderne'.

Vaughan tantalises modern readers. He offered a wide assortment of treatments, although more limited than in other advice books. Purgatives, syrup of poppy (a mild sedative), and herbs for stomach complaints, among many others, remained in practice until relatively modern times; some are still accepted today for their therapeutic actions, often symptom relief. Moreover, Vaughan's attention to environmental factors and temperate living has stood the test of time despite changing details and theories. At the same time, many treatment recommendations cannot be justified by today's standards of evidence, or even those that had emerged by the eighteenth century when practices were nearer those current in Vaughan's time.

Placebo actions. Critics, nowadays, commonly dismiss, with exceptions, treatments from early times as mere placebos. Undoubtedly, placebo actions took place just as they are significant in therapy today. While it is sheer speculation to suggest that Vaughan consciously recognised imagination as a factor in the actions of his medicine – a placebo response – rather than God's hand, he believed in the power of the mind and imagination in illness. Once he noted that, in treating 'bodies griefes' and 'spirituall sicknesses,' the physician must change the imaginative faculty by endeavouring to 'deceive, and imprint another conceit.'[73]

Yet aside from a possible role for imagination, Vaughan's advice and treatments fitted with cultural/medical beliefs of his time, for instance, the power of God, public appreciation of the need to balance humours, acceptance of medical authority, recognition of astrological influences, individual diversity and the need to try different remedies. In drawing on these in one way or another, individuals might well add specific placebo responses to a simple or polypharmaceutcal treatment. Responses that, even today, may be considered to aid the healing power of Nature.[74]

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Endnotes and References

1. Withey A. *Physick and the Family. Health, Medicine and Care in Wales 1600-1705*. Manchester: Manchester University Press, 2011.
2. The commemorative phrase is on a memorial plaque in St Cyndeyrn's Church, Llangendeirne, Wales, noted in Sir William Vaughan Project http://swvp.ca/swvp_emn.pdf under 'William Vaughan' presentation to Early Modern Network 10 February 2012.
3. Withey, Ref. 1: 59 indicates this for around 1700.
4. For context an estimated 153 vernacular medical titles were published before 1605 including those by recognised medical practitioners: Slack P. Mirrors of Health and Treasures of Poor Men: The use of the vernacular medical literature of Tudor England. In Webster C (ed.) *Health Medicine and Mortality in the Sixteenth Century*. Cambridge: Cambridge University Press, 1979: 237-73.
5. Source: Sir William Vaughan Project website. http://www.swvp.ca/
6. The two medical works are: (1) *Naturall and Artificial Directions for Health derived from the best Philosophers as well as moderne, as auncient.* London: Bradocke, 1600. The book reached six further editions with variations in title pages: 1602 (a reprint in black letter), 1607 (minor revision), 1612 (revised), 1617 (the last major expansion/elaboration/revision, hence mostly quoted in this account); thereafter, some editorial changes in 1626, but not in 1633. Hereafter, the book is abbreviated in notes as *D for H*.

   (2) *The Newlanders Cure.* London: Constable, 1630 (abbreviated to *NC* in notes). All quotations are verbatim apart from silent editing to change inconsistent capitalisation and an occasional spelling for clarity. (For overview of Vaughan's publications: Davies C. William Vaughan. *Oxford Dictionary of National Biography*, online.)
7. In reality constant exchanges occurred between the oral tradition and 'physicians' medicines' both always changing as reflected in surviving ms. recipe books. Wear A. *Knowledge & Enlightenment in English Medicine 1550-1680*. Cambridge: Cambridge University Press, 2000: 47 et seq, makes the point of physician superiority. Wear's chapter on remedies provides much background to Vaughan's medical times. The term 'home' (or 'household') medicine is used here to cover both what is now called 'folk medicine' and items purchased from an apothecary (a practice noted by Vaughan). The term is broader than 'kitchen physic', often viewed as limited to items prepared at home.

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8. For quote, Poynter FNL and Bishop WJ. A Seventeenth Century Doctor and his Patients: John Symcotts, 1592?-1662. *Publications of the Bedfordshire Hist Rec Soc* 1951; 31: 26. Symcotts also warned about the advice of neighbours (p. 20).

9. 'Approved' appeared on the title page of 1612 and 1617, but was implicit in all other editions with the wording from the 'best physicians'. For age of deceit: *D for H.* 1617: 151. Vaughan made clear his respect for honest physicians elsewhere, as in *The Golden-Grove Moralized in Three Bookes*. London: Stafford,1600: book 3, chap. 45 (The book is a guide to ethical and virtuous living.)

10. *D for H.* 1617: 182.

11. *D for H.* 1617: 123.

12. *D for H.* 1617: 117.

13. *NC.* 1630: 66.

14. Quote from title page of 1612 and 1617 editions of *D for H.*

15. A sense of his love of writing and of service is underscored by his pleasure at the success of previous editions of *D for H* (see 1626: A1r.) For reference to clients, *D for H.* 1600: A4r; concerns for 'remote places' (*D for H.* 1617: 1) included the 'Southerne part of Newfound-land.'

16. *D for H.* 1600: 66. Although this was omitted from later editions, his belief remained explicit. A number of historians have emphasised the role of experience as part of proof, recently LeJacq SS. The Bounds of Domestic Healing: Medical Recipes, Storytelling, and Surgery in Early Modern England. *Social History of Medicine*, 2013; 26: 451-68, especially 456. No inkling exists of recognition of the *post hoc ergo propter hoc* fallacy.

17. *D for H.* 1617: 223.

18. *D for H.* 1617: 92. For further details of the turnip episode, Crellin JK. Early Settlement in Newfoundland. The Scourge of Scurvy. *Can Bull Med Hist* 2000; 17: 127-36. Obviously the trial was not undertaken in the context of modern carefully controlled trials. Given Vaughan's early enthusiasm, it is noteworthy he did not single it out in *NC.* 1630: 5, merely including it with recommended lemon juice and salt of scurvy grass as part of a lengthy regimen.

19. *D for H.* 1617: 144-5.

20. *The Golden Fleece Divided into three Parts, Under which are discouered the Errours* of *Religion*, the *Vices and Decayes* of the *King-dome*. London: Williams, 1626: part 3, 12.

21. (i) *D for H.* 1612: 86; (ii) *D for H.* 1617: 170; (iii) *NC.* 1630: 81; (iv) *NC.* 1630: 95.

22. *D for H.* 1626: A1v.

23. *D for H.* 1612: 4.

24. Despite the value of a broad knowledge of alternatives to suit individual needs, it is not unreasonable to suggest that practitioners tended to use a relatively small number of medications with which they had familiarity. Limited usage in households has been noted, e.g., Stobart A. 'Lett her refrain from all hot spices': medicinal recipes and advice in the treatment of the King's Evil in seventeenth-century south-west England. In DiMeo M and Pennell S (eds). *Reading and Writing Recipe Books,1500-1800*. Manchester: Manchester University Press, 2013: 203-24.

25. *D for H.* 1617: 72-3.

26. *D for H.* 1617: 94.

27. *D for H.* 1617:191. Examples of others: 128.

28. *D for H.* 1617: 215-6. In an essentially religious writing published in the year of his death (1641), Vaughan again noted the power of simple remedies with '*Gods blessing*:' *The Soules Exercise, In the daily Contemplation of our Saviours Birth, Life, Passion, and Resurrection*. London: Cotes, 1641: 5-6.

29. Quote: *D for H.* 1617: 14. For proverbs and notions of proof, see Woodburn R. *Proverbs in Health Books of the English Renaissance*. PhD dissertation, Texas Tech University, 1975. Woodburn points out that while precisely defining a proverb is problematic, its essence is a brief statement of a truism or an observation accurate enough to gain popularity and warrant consistent usage.

Although the notion of common sense (an accumulation of information from the various senses, in essence, intuitive knowledge) is not made clear in Vaughan's writings, it is implicit in Vaughan's concerns over compounded remedies. Vaughan would probably have been happy with the much later comment by John Wesley: the 'common method of compounding medicines can never be reconciled to common sense. Experience shews, that one thing will cure most disorders, at least as well as twenty put together'. (*Primitive Physick: or an Easy and Natural Method of Curing most Diseases*. Dublin: Nelson, 1752: xv).

30. He added his 'chiefest pleasure' in 1626 (*D for H*: A1v.) Rather than 'best physicians', the first three editions used the term 'best philosophers,' a term Vaughan noted to be confused with physicke as both respected 'Naturall Bodies' (*The Golden-Grove, Moralized in Three Bookes.* N. 9.)

31. Huarte J. *Examen de Ingenios*, *The Examination of Mens Wits* (trans. R.C. [Richard Carew]). London: Flip, 1594: 181.

32. *D for H.* 1617: 277 for inconsistent information.

33. *D for H.* 1617: 51; p. 4 for acquaintance with the *Aphorisms*.

34. *D for H.* 1617: 280.

35. *D for H.* 1617: 105 in discussing exercise.

36. Citations: *D for H.* 1617: 82-3 for Marsilio Ficino (1433-1499). Vaughan called him a physician though the extent of formal medical education remains unclear. Jean Fernel (*D for H.* 1617: 109); Felix Plater (*D for H.* 1617: 151 and 198 respectfully, also *NC.* 1630: 88.)

37. For Hugh Plat, *D for H.* 1600: 14, 18. For the influences of Plat, including medicine, Thick M. *Sir Hugh Plat. The Search for useful Knowledge in Early Modern London*. Totnes: Prospect Books, 2010.

38. E.g. *D for H.* 1626: 1.

39. *D for H.* 1617: 16, for 'sparing;' 108-12 for fasting and abstinence; *D for H*, 1617: 16 for quote about Ireland. See also regimen for '*sweating-sickness*,' D for H. 1617:15.

40. For the place of *The Newlanders Cure* in the literature of Canada, see *Early Canadiana* online http://eco.canadiana.ca/; Also Cell G. William Vaughan. *Dictionary of Canadian Biography*, online.

For one view as a health manual for Newfoundlanders: 'William Vaughan' (swvvp/sw.emn.pdf) noting that the book: 'presumably written during his Newfoundland stay, is a medical work, treating of the complaints most prevalent in Newfoundland.' At best, Vaughan reminded readers that his 'zeale to New-found Land [was] not frozen' and that his wish was 'to stirre up our Islanders Mindes to assist and support for a time our New-found Isle' (*NC.* 1630: B1v). This followed many previous references to Newfoundland in *Directions for Health* and other non-medical books. It is easy to assume that Vaughan sent copies of his 1612 or 1617 *Directions* with settlers to

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Newfoundland. (Eburne, R. *A Plaine Path-way to Plantations.* np: GP, 1624: 107-8 noted the diverse men and women Vaughan sent thither.)

Even a cursory glance at *The Newlanders Cure* suggests that the life style would be difficult to follow. An assessment of the relevance of Vaughan's book for the diet of colonisers can be started with Hodgetts L. Feast or famine? Seventeenth-Century English Colonial Diet at Ferryland. Newfoundland. *Hist Archaeol* 2006; 40: 125-38. Further, it is unlikely that many medicines suggested would be unavailable. It is difficult to imagine, without any evidence, that an ideal medicine chest such as in Woodall J. *The Surgions Mate.* London: Griffin, 1617: A1r-A4r would be available to fishers or colonisers. For background, Appleby JH. New Light on John Woodall, Surgeon and Adventureer. *Med Hist* 198; 25: 251-68.

On Vaughan's awareness of age and sense of duty: *NC.* 1630: A4v, A5v-A6r. Motivations for writing also in Prescott AL. Relocating Terra Firma: William Vaughan's Newfoundland. In Warkentin G and Produchny C (eds). *Decentring the Renaissance. Canada and Europe in Multidisciplinary Perspective 1500-1700.* Toronto: University of Toronto Press, 1996: 125-40.

41. *NC.* 1630: 9-10, 57. At least one might have expected mention in his 1617 much revised edition. For Lessius, see Havens RA. *The Rule of Health and the 'Prince of Philosophers': the Hygyiasticon* [Antwerp 1613] of Léonard Lessius. Master's Thesis, University of Texas at Austin, 2011. For some general background on matters of diet, Shapin S. How to Eat Like a Gentleman, Dietetics and Ethics in Early Modern England. In Rosenberg CE (ed.) *An Anglo-American Tradition of Self-Help Medicine and Hygiene.* Baltimore: Johns Hopkins University Press, 2003: 21-58.
42. *NC.* 1630: 10.
43. *NC.* 1630: 54.
44. For respective quotes *NC.* 1630: 22 and 11.
45. *NC.* 1630: 22 et seq. Also to preserve a person 'from the plague.'
46. *NC.*1630: 18 for quote.
47. *NC.* 1630: 11, 4 respectively for quotes. See also his lengthy account in verse in the same volume '*The minds infirmities*,' pp. 94-136.
48. It seems appropriate to notice here an explicit statement on tailoring treatment from another author: '*Therefore I strive by diversity of medicine to fit every complexion, and make every man cunning in his own constitution.*' (Brugis T. *The Marrow of Physicke . . . Being a Medicamentary.* London: Hearne, 1640: A5v.)
49. *NC.* 1630: 60.
50. *NC.* 1630: 23. Note also. 'Why will they [he wrote] cumber themselves with Apothecary-drugs, while they may be delivered from diseases without danger, onely by observing a competent dyet.' *D for H.* 1617: 124.
51. *D for H.* 1617: 16.
52. *D for H.* 1612: 86.
53. Quotes: *D for H.* 1617: 150; *D for H.* 1600: 66. The spirit (distillate) of *Rosa solis* was well known.
54. *NC.* 1630: 2, 44. In 1607 he replaced reference to the quintessence with the following: 'it may be done, first by Gods permission, by observing a good diet, and sometimes by using of some Treacle, Methridate, or such like in the spring time and autumne.' *D for H.* 1607: 92.
55. *NC.* 1630: 73. Vaughan's 'pantemagogen' is presumably 'pantemagon' (generally written as pantagogus) since it was an antimonial preparation alternative to stibium. This preparation has been confused with 'panchymagogum,' a compound vegetable purgative, but it seems unlikely Vaughan had this in mind. The purgative was invariably an initial approach to treating scurvy for which Vaughan, as did others, offered a confusing number of treatments.
56. *D for H.* 1612: 85.
57. *D for H.* 1600: 38 and elsewhere.
58. *D for H.* 1617: 123.
59. *NC.* 1630: 60.
60. For rhubarb, *NC.* 1630: 51. One wonders what readers understood by 'rhubarb.' Although the 'superior' Chinese rhubarb was well recognised by the early decades of the seventeenth century, other rhubarbs, maybe docks similar to rhubarb but only mildly laxative, were likely used. Cf. Faust CM. *Rhubarb, The Wondrous Drug.* Princeton: Princeton University Press, 1992:18-45. For reference to mechoacan, *D for H.* 1617: 129.
61. *D for H.* 1600: 40-1; 1617: 125-6.
62. Assuming Vaughan was reflecting on local experience with apothecaries, cf. Withey Ref. 1: 109-16.
63. *NC.* 1630, p. 51; official recognition was marked, for example, by inclusion in the *London Pharmacopoeia* of 1618: *Pharmacopoeia Londinensis.* London: College of Physicians & Griffin, 1618: 91. Other successful preparations, prepared tutty for eyes (*NC.* 1630: 28; unguentum Aegypticum *NC.* 1630: 65). For some suggested remedies, Vaughan added quantities, facilitating home preparation such as the purgative, an oxymel: '*roote of rhuebarbe, or mechoacan three dragmes, hermodactilis two dragms, turbith three dragmes, an ounce of diagredium, two scruples of cinnamon and ginger, three pounds of sugar.*' A dose of '*six dragms at a time.*' (*NC.* 1630: 72.)
64. For one exception, a vegetable purgative (D for H. 1617: 209-10), for which a number of the ingredients merely created a distinctive, palatable, flavour.
65. *D for H.* 1607: 92; 1617: 172; 1617: 13, respectively.
66. *D for H.* 1600: 67-9. The reputation was aided by pharmacopoeial status in 1618 (*Pharmacopoeia Londinensis.* N. 63: 10.) Doctor Stevens Water, which has been attributed to the French physician Charles Estienne, is one of the enigmatic cure-alls. Its long-standing reputation and changing detail may throw light on the persistence of a reputation. (Vaughan did not mention that Stevens had been bedridden for the last ten years of his life as noted in Partridge J. *The Treasuries of Hidden Secrets commonly called the good Huswives Closet.* London: Johnes, 1596: Chap 105. Increasingly, too, initial enthusiasm of the Water in prolonging life faded to a sense of it being a general stimulant or cordial.
67. The one example was in fact a remedy attributed to B.R. ('Proved by B.R.') who has not been identified and may have been a local practitioner. (*D for H.*1617: 203-4.) In terms of not using the term, note Thomas Brugis (1640) stated that he included '*many receits by me daily practised (and therefore need no Probatum to be annexed.)*' *The Marrow of Physicke.* N. 48: A1r. The title page noted the addition of '*divers experimented medicines*'.
68. For one reminder of the Empirical school, Bacon F. *The Twoo Bookes of Francis Bacon . The Proficience and*

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Advancement of Learning, Divine and Humane. London: Tomes, 1605: book 2: 48v.

69. Barrough P. *The Method of Physick*. London: Richard Field, 1596: A7r. Surgery clearly demanded experience, cf. Lowe P. *The Whole Course of Surgery*. London: Purfoot, 1597: B3r-v.

70. Cotta J. *A Short Discoverie of the Unobserved Dangers of Severall Sorts of Ignorant and Unconsiderate Practisers of Physicke in England*. London: Jones & Boyle, 1612: 4.

71. For example, cf. Oberndorf J. *The Anatomyes of the True Physition*. London: Johnson, 1602. Vaughan himself had noted eight considerations in administering a purgative.

72. For comments on 'defects' such that '*most learned Practitioners, fall often short in performing the cures they promise*': Hall J. *Select Observations on English Bodies: or, Cures both Empericall and Historicall, Put into English by James Cooke*. London: Sherley, 1657: A6r. Admittedly, considering 'defects of observations' as a way of thinking only became more consistent after Vaughan's death.

73. *D for H*. 1617: 230-1.

74. In this context, a preliminary survey of Vaughan's materia medica by the late Professor David Cowen (personal communication) indicated that most items (single and compound) listed by Vaughan were mentioned in well-known medical books of the seventeenth century until often fading in the revision of the materia medica during the eighteenth century. However, while overlap in various uses existed, there was also considerable variation that hinted at limited observations or experiences, maybe placebo responses.

Personal reflections on investigations of medical crises in the 1970s: contaminated glucose drips and a smallpox case

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Infections acquired in hospitals are common, but it was only after two incidents in the UK and US that governments took a hand. The UK Clothier Report focussed on deaths without probing deeply into the manufacturing of the contaminated fluid. There had been serious breaches of accepted practices even after a previous incident. Although there had been five deaths, the Committee did not examine the clinical notes of patients, made few recommendations and only listed the qualifications of medical doctors.

In the USA, bacteria entered the fluids after autoclaving, with at least 500 patient deaths. A Federal laboratory published many scientific papers and reviews and checked laboratory procedures.

A smallpox case in London in 1973 was the subject of the 1974 Cox Report of 156 pages with maps and illustrations. Unlike the Clothier Report, there were six pages of recommendations, not only for the London School, but for other bodies.

Introduction

When things go wrong, governments investigate. Sometimes they appoint an enquiry, sometimes a government department investigates. In the early 1970s contaminated glucose infusions caused infections in both England and the United States. In England, a committee made a quick and unsatisfactory enquiry, whereas in the USA, the Federal Center for Disease Control (CDC) began a research programme to understand the problem. At the same time in London, a laboratory accident was the background for a committee to recommend a major review of laboratory safety.

Sterilisation of a liquid is simple in theory, but difficult to achieve consistently when millions are needed. Many patients receive infusions of fluids and if the fluid is not sterile, the patient's life may be at risk. In 1970 six million litres of intravenous fluids were used every year in British hospitals. As about eight million patients received one or more infusions every year in the USA, even a very small level of contamination may result in many cases. In the USA nearly two million infusions were made every week and there had been a silent epidemic of illness and deaths among those receiving bottles of fluid – 8,000 hospitals had used bottles from Abbotts. In 1971 it was thought that perhaps 5,000 patients had been infected and 500 had died. Two major incidents involving glucose drips, in the US in 1970-1971 and England in 1972, were investigated with far-reaching results. The investigations provided a contrast in style and show how government bodies deal with commercial firms in cases where patients' lives are at risk.

In both countries, hospital personnel noticed a temporal relationship between the giving of infusion liquids and unexpected fever in patients. Tests showed that the infusion fluids were contaminated with bacteria. The fluids were withdrawn until the cause of the contamination could be rectified. In England, due to faulty production, the infusion fluid had not been properly sterilised. In the USA, contamination had occurred after sterilisation: a new plastic liner replaced a previous one and this allowed entry of bacteria via the screw cap closures.

In England, a small outbreak of septicaemia in one hospital, with five cases, of whom four died, was investigated by a government committee of a judge, a pharmacist and the Director of the Public Health Laboratory Service (PHLS).[1] They were limited to the one hospital and the manufacture of the contaminated drip and they reported in three months (*The Clothier Report*).[2] Eighteen months later a short paper was published in *The Lancet*[3] and a critical article appeared in *Private Eye*.[4]

In the US there was no official inquiry, but the Federal Center for Disease Control (CDC) investigated 25 hospitals which had reported suspected septicaemia in patients receiving a glucose [dextrose] infusion. The scientists published details of many laboratory experiments in medical journals from 1972 to 1976 and

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the CDC National Nosocomial Infections group also made a survey of many hospitals.

These inquiries resulted in far reaching changes in manufacture and hospital practice in the two countries and resulted in specialist societies, journals, books and symposia. I compare the Clothier Report with another enquiry in England in 1973 and the responses in the two countries.

The outbreak in Devonport and the Clothier Report

After some hospital patients had severe reactions while having treatment with a glucose drip, it was suspected that the glucose solution, manufactured by Evans Medical of Liverpool, was contaminated. A local investigation was made, but a full government inquiry was made by the Clothier Committee, whose report was made to the British Parliament.

The Clothier Committee investigating Evans Medical chose to interpret its brief very narrowly: for instance 'it was not concerned with the cause of death of any particular person or persons' (para 4). The only other mentions of any consequence of the use of the contaminated infusion fluid are in paras 6 (10) and 55 where 'there was a succession of untoward reactions in patients' – the number was not given. The nature of the untoward reactions was given in *the Lancet* paper:[3] four patients died (one of them died 20 minutes after collapse while having a glucose infusion); one other collapsed while having glucose infusion, but was successfully resuscitated; and two others died in circumstances suggesting that they had been infused with contaminated fluid. Six deaths in Plymouth due to contaminated fluids were reported in *Private Eye* as early as 24 March 1972.[4]

Infusion solutions are made sterile by one of two methods: by *autoclaving*, for example 30 min at 240°F (122°C) in a sealed glass or more rarely plastic container *or* by irradiating fluids in a sealed plastic container. Autoclaving was supposedly the method used by Evans Medical and was described in detail (paras 7-9). There had been a number of incidents in the UK and the USA when bacteria had survived the process or had entered the fluid either from non-sterile water used to cool the containers or later (para 32).[5]

The Committee investigated only the single sub-batch of fluids used at Devonport. This originally comprised 612 bottles and sterility tests had been done only on bottles from the top of three vertical layers. The committee considered that bottles in the two upper layers were sterile, those in the lowest not. Of the remaining 600 bottles only 155 were recovered and of these 54 were considered to be contaminated. What had become of the other 445 bottles? Single bottles only were recovered from the two other hospitals, Plymouth General Hospital and Greenbank and Freedom Fields (Appendix 5). Should someone have looked at the records of those hospitals for 'any untoward reactions' in those and perhaps other hospitals in the area? Nowhere in the main body of the report is there any indication that bottles from this sub-batch were recovered from other than the Devonport Hospital (para 59: 'only 155 bottles had been recovered ... all of these came from Devonport Hospital ... no returns from any unexpected quarter'). The *Lancet* paper was sub-titled 'The Devonport incident' and no other hospital was mentioned.[6]

Moreover, the Committee recorded that 'on some 70 occasions … between May 1970 and September 1971 sub-batches of products had been produced for which the temperature recorder chart showed an inadequate cycle, generally no rise in temperature ...' (para 18). The Committee's terms of reference apparently prevented it from investigating this further. The Committee had the batch numbers of these products and could have seen the quality tests on them. The Committee could have tried to trace where and when these sub-batches had been used and inquired about 'untoward reactions' in patients.

The report made clear that sample bottles for chemical testing were taken by laboratory staff, but bottles for sterility and pyrogen testing were taken by production staff (para 38). Both samples were taken from the top layer of each cage (para 40). This was faulty procedure: all sampling should have been made by laboratory staff and samples should have come from different layers. This was a serious breach of an understanding with Ministry of Health inspectors following an incident in 1966 when infusion fluids at Evans Medical were found to be contaminated (paras 32-35) and a breach of the *Orange Guide* (HMSO 1971).[7] The release for sale was signed by the manager of the production unit – another serious breach of the *Orange Guide.*

However, the Committee only said that information indicating that the test results were satisfactory was sent to the production manager (para 38). This was not the same as saying what the results of the test were. Did the Committee examine the records sent to the production manager and also the laboratory records of the tests? I think not, for if they had, one of two possible results might have been reported. It is implied that sampling by the laboratory staff was satisfactory, as no criticism was made of it. Yet the laboratory samples were tested for the presence of hydroxymethylfurfural 'produced during the heating of dextrose solutions and is rarely therefore completely absent after autoclaving. Its complete absence from samples might indicate inadequate heating' (para 73).

Strangely, the results of this test were not included in the batch records, instead being separately recorded (para 73). Why? When tests to simulate the operating cycle on the autoclave were made by a ministry inspector, the temperature in the lowest of the three layers did not exceed a temperature of 118°F (48°C)during the cycle (para 26). Unfortunately, the time of the cycle was not given and elsewhere there is evidence that the cycle for the contaminated glucose bottles might not have been the minimum of 30 minutes (para 31). If the temperature only reached 118°F or even 'up to 176°F' (80°C) as the report assumed elsewhere (para 27), it seems most unlikely that there would have been any hydroxymethylfurfural in any sample bottles from the bottom layer. This means that either the sampling by the laboratory staff was as negligent

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as by the production staff or that hydroxymethylfurfural was not found in properly sampled bottles, yet the sub-batch was still passed. Whichever reason, it was convenient that the records never left the chemical testing laboratory. The Committee should have investigated this.

How many bottles were contaminated?

It was assumed by the Committee that 'as two-thirds of the bottles of the sub-batch recovered were shown by laboratory examination to be sterile, … a satisfactory cycle must have been achieved for the two upper layers' (para 31 and also para 28) and this is emphasised as 'the remainder were sterile' (i.e. 2/3) (para 24). This was based on the report by Dr Meers that of 155 bottles inspected, 54 were estimated to be contaminated (Appendix 5).

However, earlier in Appendix 5 and in *the Lancet* paper,[8] details were given of the distribution in the two samples: 120 found sealed in 10 unopened boxes at Devonport Hospital and 35 other bottles, 2 opened and used, together with 31 unopened from Devonport and one each from Greenbank and Freedom Fields Hospitals. The results of the tests were shown in Table l: a statistical analysis strongly suggests that the two samples were from different sources.

Thus the premise of the Report is unfounded. Dr Meers stated that the distribution of cloudy bottles, i.e. contaminated, in the unopened boxes 'is not Poissonian' (Appendix 5), i.e. that it was not random. This was changed by the Committee to 'Dr Meers found no significance in the distribution of contaminated bottles amongst the unopened cartons' (para 78) – not the same thing at all. The Committee and Meers et al made the assumption that the non-Poissonian distribution of contaminated bottles in each opened case of twelve bottles, two cases having no contaminated bottles, showed that all the contaminated bottles remained together.[9] However, the chance of one case containing twelve uncontaminated bottles if one third of the sample is contaminated, is $(2|3)^{12}$ or one in 130. The chance of two cases is one in 130 squared or almost one in 17,000. However, as Table 1 shows, the true level of contamination was 28% in these cases. Assuming 25% contamination, the chance is one in 32 of them being in one case, or one in 1024 of there being two cases without any contaminated bottles. There is therefore very little chance that these ten cases of bottles all came from the lowest level of the autoclave.

At least one and probably two of the cases must have come from another layer. But which other layer? Tests of the autoclave were made by a Department of Health and Social Security (DHSS) inspector who stated that 'bottles in the lowest layer did not exceed a temperature of 118°F', but stated that 'bottles in the upper part on the autoclave reached 240°F' (para 26). No indication was given on how these measurements were made. The importance of autoclaving is 'to maintain the fluid at 240°F for 30 mins' (para 7). The wording of the inspector's report suggests that it was reached, but may not have been maintained for the full time. The survival of bacteria in an autoclave is represented by a logarithmic decay curve over time (i.e. a straight line on a semi-log plot). Thus the probability of there being any survivors is dependent on the temperature, the duration, the slope of the decay curve (a constant) and the *initial number of bacteria* in the bottle.

It was assumed in the report that *all* the bottles contained living bacteria before autoclaving. This would seem reasonable as six of thirteen tested bottles contained bacteria of two different species (Appendix 5). However, tests for the bacteriological content of the bottles *before* autoclaving were carried out weekly (para 71). The Committee could have inspected the records and discovered the customary level of such contamination. It could have compared this with the specifications for intermediate products (if such specifications existed) to see whether a contributory cause could have been a larger than usual number of bacteria in the fluids before autoclaving: this would inevitably have led to a higher probability of contamination after faulty autoclaving. The Committee did not enquire if the production staff had control of the rejection of the intermediate product if it failed the specifications. This should be the duty of the Quality Controller.[10] Presumably the records of the weekly specification monitoring should have been attached to the records of each batch. Were they?

The conclusion must be that the 35 loose bottles recovered were probably from the bottom and middle layers, that eight of the unopened cases probably came from the middle layer and that two unopened cases may have come from the top layer. This can be tested. The chance that the 35 loose bottles and the eight cases containing contaminated bottles came from the same lot was >0.005 and <0.002 (Yates' test), i.e. the contamination in the eight cases was significantly lower. If this reasoning is correct, there were 200 contaminated bottles from the bottom layer and another seventy two from the middle layers, a total of 272.

The Committee concluded that as 2/3 of the recovered bottles were sterile, 'a satisfactory cycle must have been achieved for the two upper layers' (para 31). This would imply that they accepted 200 contaminated bottles of which only fifty four had been recovered (para 77). Dr Owen, MP for Devonport, asked the Health Minister about these other bottles: the Minister replied that 'the evidence is that the other bottles were probably used with no ill effects'.[11] There is no evidence for this in the Inquiry. It is odd that eight bottles used at Devonport resulted in four deaths, two possible deaths and one collapse whereas the untraced l40 bottles were used with no ill effects: Meers et al concluded that the contaminated bottles began their life (!) together, were packed and stayed together. They further concluded that there was a maximum of 62 contaminated, of which 54 were recovered, 'plus at most eight used on patients and not subsequently traced'.[12]

I suggest that the statistical examination of the data suggests that 270 bottles may have been contaminated and that 200 were not traced. A check of hospital records

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in the South West could have been made to trace any 'untoward reactions' during or following glucose drip infusions.

Personnel and Criticisms

The qualifications of the Committee were given (Appendix 1), but not those of any other person except those prefaced by 'Dr', where no distinction was made between MD, PhD or the courtesy title (Appendix 2 and para 55). This makes it difficult to know which persons at Evans Medical were professionally qualified – and thus with a double responsibility. The Committee exonerated Dr Smith, the Managing Director, and Mr Emery, the Production Director: it said that Mr McDonald, the Chief Analyst (= chief of quality control) shared 'some responsibility because of his failure to put in hand inquiries designed to reveal shortcomings in company practice' (para 46). The shortcomings were not listed, but one was mentioned earlier, 'the major defect in release procedure in the Transfusion Unit' (para 46). Yet the *Orange Guide*[13] shows many sections to be relevant (see Appendix 2 below).

No reader of the *Clothier Report* would suspect the extent of the responsibilities of the Quality Controller as defined in the *Orange Guide,* which consists of a collection of known and accepted good practices (para 36). There was no aspect of the operations at Evans Medical which conformed to the *Orange Guide*.

The Committee did not ask for the tests, the records or anything. Were there no unopened representative samples which could have been examined? The management had a draft of the *Guide* in 1970 (para 37), many of the staff were professional persons who must have read articles about the *Orange Guide* in their professional journals; if they had not, the Committee should have admonished them. There is no evidence that any start had been made on the implementation of any part of the relevant sections. Dr Smith and Mr Emery, 'do not bear responsibility in any real sense' as 'they were entitled to rely on Mr Smart, the Pharmaceutical Production Manager (para 45). This is extraordinary: they were professional men in positions of authority who must bear responsibility for their omissions and their failure to see that their responsibilities were carried out – unless their subordinates hid or misled them.

However, the management was responsible for carrying out the 'understanding ... between the management ... and Inspectors of the Ministry of Health as to the role of quality control in the management of the production of infusion fluids' following their contamination in 1966 (para 32). The Report does not clearly state what this understanding was, but apparently six years was not long enough to make it effective. Yet there was no censure of the management, the Quality Controller or the Pharmaceutical Production Manager, all of whom should have known what the understanding was.

It is curious that while the Committee made no recommendations relating to Evans Medical (paras 81, 82), it considered that the 'absence from the *Orange Guide* of guidance on sampling procedures ...' should be a matter to be considered by the Medicines Commission [para 81 (8)]. One would have assumed, as the framers of the *Orange Guide* assumed, that the principles were well known. There were other matters not considered by the Committee.

Who was responsible for maintenance?

Itr is not clear why there were virtually no entries made on the maintenance records after 1969 (para 18) or why the maintenance was faulty or non-existent for several years (para 18). The lack of maintenance 'allowed the equipment to deteriorate to an extent which would preclude its use for' testing the sterilising procedure: one of the recommendations of the Ministry Inspectors in 1966 (para 33).

Who drew up the Operating Instructions for Autoclaves (Appendix 4) 'which were faulty'; was it the Quality Controller? Who had the authority to check that they were carried out and when were they drawn up? Were they the instructions drawn up with the Ministry Inspectors in 1966? (para 32).

About December 1970, a late manuscript addition to the capital estimates was made by Mr Devonport, [manager of the transfusion unit], after discussion with the instrument technician, asking for replacement of all six temperature recorders (para 15). This must surely have been seen by management who must have realised that one doesn't replace all six temperature recorders if they are working properly. The Report merely says that 'for one reason or another this request was not followed up' (para 15). I have previously mentioned a number of questions about the quality control which should have been asked.

Individuals and the Inquiry

The first person to notice anything wrong was Staff Nurse Picton who, on the night of 1st March, rejected a bottle of glucose drip because it was cloudy. 'Owing to the urgency of other matters subsequently demanding her attention' this bottle was lost (para 54). One might think that her action deserved praise, instead 'the Committee considers no blame whatever attaches to the actions of Staff Nurse Picton' (para 54). In the three days 1-3 March 'there was a succession of untoward reactions in patients of Mr Gall and Mr Reilly'. [Surgeons in the UK were addressed as 'Mr'. Other medics assumed the title of 'Dr' whether or not they possessed a MD or PhD.] It took three days in which five patients died and two others collapsed before Mr. Gall took the 'inspired decision' to stop the glucose drips (para 55). 'In the Committee's opinion the prompt and correct actions of Mr Gall and his colleagues deserve the highest commendation' (Para 55). 'Prompt' – three days after five patients had died ? The action of Nurse Picton probably saved the life of her patient, but she received no thanks.

Fifty seven other people were listed in Appendix 2 as having given oral or written evidence. No qualifications were given for any of these people although many are given the title of Dr. Mr Devonport was a 'qualified pharmacist' (para 43). The two consultant surgeons were

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referred to as Mr in the body of the report, but were given the title of Dr in Appendix 2. It is unclear whether the Managing Director of Evans Medical was a chemist, biologist or pharmacist with a PhD or was a medical doctor. Various nurses would have had appropriate qualifications, but the report does not show if the staff at Evans Medical had adequate professional qualifications or experience for their jobs and responsibilities.

Events at Evans Medical after the Incident

Evans Medical were informed on 4 March, a Saturday, of the contaminated fluids and other distributors in the country were also warned (para 57). How Evans Medical reacted to the information is not recorded in the Report. The urgent investigation was begun by the Department's Inspectors (para 59) and it was an inspector who tested the autoclave (para 26). The Report infers that only the Transfusion Unit was investigated (para 26). It is clear that the investigation should have included the Quality Control Unit. Indeed, there is no mention in the Report of any internal investigation by Evans Medical, although this had taken place previously after the 1966 inspection (para 32).

It was not until 8 March that the Department, in agreement with Dr Smith, placed an embargo on all Evans Medical infusions. The faulty operation of the autoclaves and the failure of the sterilisation process was presumably discovered on 7 or 8 March: what had Evans Medical been doing on the Sunday and the Monday and possibly even the Tuesday? The Clothier Committee was appointed on 17 March, the *Private Eye* article appeared on 24 March and the preliminary hearings began on 27 March, yet at the end of the inquiry on 16 June the Report contained no information of any changes at Evans Medical, no record of any new understanding with the Ministry, not even that six new recorders had been ordered or installed. On 12 July, after the publication of the *Clothier Report* Evans Medical accepted the findings and deeply regretted the circumstances leading to it. Essential management changes were being made.[14] Thus after 4 months changes were still not complete.

The *Orange Guide* and Sterile Products

The *Orange Guide* emphasises the key role of an independent quality controller. Ideally, he should infuse his staff with a keen awareness of their responsibility – responsibility to the users or consumers of the products as well as their responsibility to the organisation. At that time many hospital pharmacy departments manufactured some of their own products. For instance in 1972, there was an outbreak of hospital infection over many months due to contaminated autoclaved fluids.[15] Tests of five autoclaved pharmaceutical products showed four contaminated, with 15 samples contaminated out of 109 tested. In clinical areas, of 33 bottles of hospital-manufactured infusion fluids which were in use on patients, ten were contaminated. The contamination was noticed because a rare organism was isolated from a number of patients. It appeared that stored water containing the organisms was used for cooling and this contaminated the outside of the bottles and was probably drawn into the bottles during the cooling cycle.

A Health Ministry spokesman said that the Inquiry would look into the safety of solutions manufactured by hospitals:[16] six of twelve hospitals visited had been asked to suspend production of infusion solutions.[17] The Minister of Health said that all hospitals had been asked to examine their manufacturing procedures in the light of the *Orange Guide* and many stopped.

After the 1966 incident, the Ministry inspectors had suggested that some bottles of each batch should be tested for sterility after a delay of a week. The *Orange Guide* suggested that some bottles of each batch should be kept until the expiry date. Phillips et al revealed a further hazard.[18] Only about one in six of undisturbed bottles in their sample was contaminated, but if the caps were banged on the bench, the number of contaminated bottles was doubled, to one third. Thus, the *Orange Guide* might be amended so that the bottles for testing should be inverted, banged firmly against a bench, left for 48 hours and then tested. Half of the bottles kept to the expiry date should also be inverted and banged.

Nationwide epidemic of septicaemia in the USA

In April 1970 Abbott introduced a new elastomer-lined closure for its intravenous products and soon patients developed septicaemia while receiving them. Products by other manufacturers using Gilsonite closures were not involved. The outbreak was monitored by federal public health doctors at the Center for Disease Control (CDC) at Atlanta, Georgia in conjunction with epidemiologists and bacteriologists in 25 hospitals. The results were published in the free *Morbidity and Mortality Weekly Report (MMWR)* in 1971-1973 and in scientific papers in medical journals from 1972 on.[19] A massive review of the problem of infection control in intravenous therapy was published, with 266 references.[20]

Experiments showed that the infecting organisms were Gram-negative bacteria usually associated with plants. The bacteria were of *Enterobacter* species including *Enterobacter cloacae*. The main contaminating organism had previously been called *Erwinia* and was better known as a plant pathogen: CDC renamed it *Enterobacter agglomerans*.[21]

In 1972 as part of its quality control programme, the Laboratory Licensure and Control Branch of CDC sent, as an unknown, a strain of *E. agglomerans* to hospital laboratories for identification.

Septicaemia

Septicaemia or blood poisoning is caused by the release of bacterial toxins into the blood from either an infection or from an outside source, e.g. a contaminated drip. In many infections there may be bacteria present in the blood and the blood may be cultured in the laboratory. Where the infection is sequestered in an abscess or the source is from a drip for example, there may be no bacteria in the blood – with a slow drip, the bacteria may

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be killed and the toxin released. Where septicaemia is suspected, e.g. when a patient who has received a new drip develops a rise in temperature, the bottle should be replaced (and preserved for investigation) without waiting for laboratory tests.[22, 23]

Kelsey argued that the concept of sterility of operations is a myth and is misleading: he suggested that attention should be focussed on process control.[24] In the UK, good process control is listed in the *Orange Guide*. However, it appears that, in practice, from four to ten per cent of fluids contain organisms, but the numbers are usually small and do not cause noticeable clinical reactions. Only a small number of organisms appear to grow in dextrose solutions: *Klebsiella, Enterobacter* and *Pseudomonas* species are the most common. Normal people have adequate humoral and cellular immunity to kill small numbers of these bacteria and any illness is likely to be caused by the infusion and release of endotoxin only.

The 1972 *Clothier* and 1974 *Smallpox (Cox) Reports* compared

In 1974 a technician at the London School of Hygiene and Tropical Medicine (LSHTM) became infected with smallpox when visiting a research laboratory there. Smallpox was not suspected and she infected three other people while in hospital. This outbreak caused two deaths directly and another due to complications following more than four million vaccinations: an inquiry (The Cox Committee)[25] followed, as many mistakes and omissions had occurred.

In 1971, a survey of safety at the School had been made, the Schilling-Hall Report, and safety measures were introduced.[26] The Committee investigated these measures, which had not been sufficient to prevent the accident. The Clothier Committee had 'considered that it was no part of its task to investigate the 1966 incident' although the non-compliance of the measures proposed were vital to the understanding of their inquiry.[27]

The Cox Committee inspected laboratories at LSHTM and visited three others.[28] Ten photographs and plans of the laboratory were included in the report. A plan, Plate XI, of the hospital ward was included and the case notes and ward bed state books were examined. The Report included an Appendix N of new methods for the disinfection of books. There was a long review of smallpox prophylaxis by vaccination, immune globulin and antiviral agents.[29] Unlike the Clothier Committee, the Cox Committee listed the qualifications of all the 95 witnesses. The Report ended with six pages of specific recommendations,[30] including a two-page code of practice, the setting up of a permanent committee of experts, details for the LSHTM and Public Health Laboratory Service (PHLS) staff, finance and outbreak control measures.

In contrast, the Clothier Report listed ten matters to be referred to the Medicines Commission in eighteen lines.[31] Evans Medical was not mentioned, but the DHSS was singled out for needing improvement in the arrangements for dealing with emergencies[32] because 'there was a slight delay in reaching the DHSS'.[33] There is no indication in the Report that the Committee visited Evans Medical to inspect the autoclaves or that they initiated any experiments.

Conclusions

Although there had been reports of previous small outbreaks of hospital infections caused by contaminated autoclaved fluids,[34] the two outbreaks in Devonport and the USA sparked a growing recognition of contaminated fluids and septicaemia, with contributions from many countries. The two incidents prompted widespread concern and the formation of journals, conferences and societies for the study of hospital infections. The Clothier Committee did not come to grips with the problems of contamination although a similar experience in the USA had possibly contributed to the deaths of at least 500 hospital patients. A similar inquiry (the Cox Committee) in the UK made many sensible suggestions and work in the USA also produced improvements. No recommendations of any worth were made by the Clothier Committee and the most glaring omission was the absence of any measures relating to the manufacturer.

Governments may appoint committees to enquire into problems, or they may entrust enquiries to their own scientists, but the outcomes may depend on the quality of those appointed.

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Endnotes and References

1. The members of the Clothier Committee:
CM Clothier Esq, QC, BCL, MA (Oxon), the Recorder of Blackpool [a legal appointment], who was later on many medical and other appointments and knighted in 1982.
Dr F Hartley, CBE, PhD, FPS, FRIC, knighted in 1977, was a distinguished pharmacist, who later became Dean of the London School of Pharmacy and then Vice-Chancellor of London University. He had been on the Committee on the Safety of Drugs and from 1972-1973 was on the Committee on Prevention of Microbial Contamination of Medicinal Products.
Sir James Howie, LLB, MD, FRCP, FRCPath was Director of the Public Health Laboratory Service (PHLS) and had been the Convener of the MRC Working Party on Sterilisers 1957-1964 and President of the BMA 1969-1970.
In *Who's Who 1983,* only the entry for Dr Hartley mentions the Clothier Committee.

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Appendix: Relevant sections of the *Orange Guide.*

From the *Orange Guide,* 1971, pages 15, 16:

> The Quality Controller should have the final responsibility to management for the approval or rejection of all items of ... materials in process, and finished products. Materials should not pass to the next stage of processing or, in the case of finished products, to distribution without the agreement of the Quality Controller. The Quality Controller should receive prior information on all changes and manufacturing procedures and written instructions.

The Quality Controller should have the following principal duties:

> The approval of specifications for starting materials ... and finished products. [If otherwise delegated, this must be recorded and the specifications approved]. Stability samples should be retained from representative production batches. The necessary revision of current control procedures and Specifications.

The Quality Controller shall be empowered to take samples from any part of the premises at any time.

Samples for quality control testing should be representative of the batch and be taken in accordance with sampling procedures which ensure that the results of the tests are significant.

In the case of finished products, reference samples should be retained. The number of units retained should be sufficient to permit re-examination ... (on previously unopened samples). Samples should be retained until the expiry date.

The Quality Controller should keep and preserve the appropriate Analytical Reports concerning the examination of each batch on products manufactured ... to include a final evaluation of the product and a decision as to whether the batch does or not conform to the accepted specifications.

From the *Orange Guide.* 1971, Appendix, pages 22, 23:

The quality control department should maintain cumulative records of the testing specified in this appendix and should take into due account the results of such testing before releasing any batch of a sterile product for distribution.

The quality control department should be responsible for the tests and for the assessment of the details on tests specified:

> records for sterile products should include details of duration and temperature of the sterilisation of the product. The charts on automatic recorders ... should constitute part on the records ... [marked to identify the batch].

Samples for quality control shall be taken by quality control staff. Regular checks should be made to verify the continuing efficiency of any sterilisation process. All such indicating and recording equipment should be ... checked periodically.

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Pharmaceutical Lore in the Lapidary of Sidrac (13th century)

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The Book of Sidrac

Le Livre de Sidrac, a work that has had scant attention in modern times, was a once highly popular text written in Old French by an unknown author some time during the last quarter of the 13th century (and certainly after 1268).[1] It defies classification by genre, containing elements of a novel, encyclopaedia and almanac. The volume is known by a number of titles, and is represented by around 70 manuscripts, with translations from ancient French into Occitan, English, Catalan, Danish, Italian, Ripuarian, Middle low-German and Middle Dutch.[2] Early copies have been recorded in the inventories of the libraries of Jean, Duc de Berry (1340-1416), Charles V (1338-1380) and Charles VI (1368-1422) of France, and the Dukes of Bourgogne (1415).[3] Careful analysis and classification of the extant manuscripts of *The Book of Sidrac* indicates that they fall into two main groups – long and short versions of the text, with much variation as to what has been included. The *Editio Princeps* appears to have been published in Paris in 1486 with at least one other incunabular version (1495), both published by the highly respected Antoine Vérard (active 1485–1512); other versions followed during the 16th century.

A Prologue is followed by an account of the life of the philosopher, Sidrac, whose name is modelled after the Biblical Shadrach. The bulk of the volume is taken up by a didactic section based upon a system of questions (as many as 1225 in some versions) covering a vast range of subjects (including occasional medical references[4]), posed by a pagan Indian king, Boctus or Boccus, and answers given by Sidrac. In one of the most accessible versions of the text (*Il Libro di Sidrac*), 557 questions are presented, for which Question 454 states 'De quants manieres et de quel vertu sont les pierres precieuses et ou se trovent ells et combient sont?' (What manner of virtues are shown by precious stones, how many are there and where do you find them?). The answers that follow make up the text of what is generally referred to as *The lapidary of Sidrac*.

English versions

English versions of *The Book of Sidrac* also belong to two groups: verse translations and prose versions, none of which contain the lapidary section. There are only two extant complete manuscripts of the Middle English poem, both dating from the second half of the fifteenth century, plus a further 8 manuscript fragments.[5] The English rhymed version was produced by Hugh of Campendene (Chipping Norton, Glos.), who supposedly lived during the reign of Henry VI and was believed to be a much travelled and highly skilled linguist.[6]

Recorded remnants of an English prose version of the work are limited to a small volume whose opening words are 'Here be certayne Questyones Kynge Bocthus of the maners, tokyns, and condycions of man, with the answeres made to the same by Phylosopher Sydrac'. The volume was published by R. Wyer in London around 1535 and contains only a specialised portion of the full text comprising 23 questions and answers.[7] Two further 16th century publications are recorded in *Typographical Antiquities*, the historical account of publishing in England from 1471 to 1600 written by the bibliographer and antiquary Joseph Ames (1689-1759).[8] *The Boke of Demaundes, of the science of Phylosophye and Astronomye, Betwene Kynge Boccus and the Phylosopher Sydracke* was printed by Robert Wyer (1550), and *A Booke of the Medicines of King Bocchus* was printed by Robert Redman, a London printer who died in 1540. The former is known, but no copy of the second title is extant, so far as I am aware.

Robert Wyer and *'a lytell boke of the xxiiii stones pryncipalles'*

Few biographical details are available for Robert Wyer. He worked as a printer and bookseller during the second half of Henry VIII's reign, carrying out his profession 'at the sign of St. John the Evangelist, at Charing Cross', premises which he rented (as part of the town house) from the Bishop of Norwich, Richard Nykke (circa 1447-1535; Nykke was the last Roman Catholic to hold this office before Henry's reforms). Following the death of the Bishop, the town house was surrendered to Henry VIII in

Figure 1. Printing device used by Robert Wyer in his *Golden Pystle* of Saint Bernard (1531)(from Plomer 1897).[9] The device in the *lytell booke of the. xxiiii. Stones pryncipalles* is very similar but lacks the printer's name.

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exchange for land in Norfolk; Henry passed the property on to his brother-in-law, the 1st Duke of Suffolk, Charles Brandon (circa 1484-1585), who retained it until his death. Robert Wyer was active as a printer at this location from c.1530, through the period of transition, until 1556 when he was succeeded by Nicholas Wyer, perhaps his son.

The change of landlord is reflected in the colophons used by Wyer, and is a useful means of giving some relative dates to the 100 or so volumes which he produced; items printed before 1536 have the 'Norwich' colophon, indicated by statements such as 'Imprynted by me Robert Wyre, dwellynge at the sygne of seynt lohan euangelyft in seynt Martyns paryffhe in the felde befyde Charynge croffe in the byffhop of Norwytche rentys'. Those published after 1536 possess the 'Sussex' colophon exemplified by Wyer's address being given as 'in the Duke of Suffolkes rentes befyde charynge Crosse", or 'befyde the Duke of Suffolkes place'.[9] In addition, some books omitting Wyer's name from the colophon, but otherwise showing clear affinity to his other publications, may represent volumes produced by other printers for him.

Wyer has been characterised as:[10]

> almost the first of Englishmen to make it his chief business as a printer and publisher to purvey cheap books for the uneducated ... The substance of the books is as characteristic as the form. Some offer the appearance of learning without its difficulty, some appeal to current superstitions, but most are practical books, containing receipts, especially medical formulae and directions, and thus appealing to the desire of Everyman to be his own physician and save a fee.

Medicine is certainly prominent among his published works, most undated and often republished on several occasions with a variety of titles, and which include: *The questyonary of cyrurgyens* (1542); an English translation of Macer Floridus's Herbal (1543); *This boke doth treate all of the beste waters artyfycialles and the vertues and properties of the same, moche profytable for the poore sycke* (attributed to Roger Bacon; 1530?); Thomas Moulton's *This is the glasse of helth* (1547?); *The gouernaunce of good helthe* (1549?); Andrew Boorde's *Dyetary of helth* (1554?); *This lytell practyce of Johannes de Vigo in medycyne* (1555?); and *Here begynneth the seyng of urynes* (1540?).[11]

There is a single extant small octavo volume held by the British Library whose opening lines are '*Here begynneth a lytell booke of the. xxiiii. Stones pryncipalles that profyteth most to mans body as ye dayand the nyght hath. xxiiii. Hours so be there. xxiiii. Stones pryncipall'*. The book is clearly from Robert Wyer's publishing stable on the basis of the form of the opening words, the address of publication, and the inclusion of characteristic woodcuts and devices. Three quarters of the title page is occupied by a woodcut of two figures, each with an empty scroll above them. One image is of an older, bearded gentleman dressed in a long cloak, emphasising a point of discussion with his raised left hand and carrying a scroll in his right He faces a younger , clean-shaven man in a smaller cloak, also with raised left hand but clasping a sword just below the hilt in his right. The image of the older man is identical to that representing the philosopher on the title page of the unattributed *The history of kyng Boccus & Sydracke.* The final page, however, features a printer's device which plays on the location of the publishing house. St John the Evangelist is seated on a promontory of land, partly surrounded by water, with the towers and walls of a city in the background. He holds an eagle in his right hand; the bird has an inkpot clasped in its beak. The device is closely similar to others from the 'Norwich' period, an example of which is given in Fig. 1, but no publisher is indicated. The volume has consequently been suggested as having been printed for Robert Wyer, rather than directly by him. The British Library catalogue entry for the volume suggests that it was produced by the Lutheran printer, Thomas Godfray, for Wyer, possibly in 1535. Godfray flourished from around 1530-1536 and is known for his publication of propagandist literature associated with the Tudor revolution; his authors included such names as William Tyndale (c. 1494-1536) and John Frith (1503-1533), plus a number of other authors closely associated with Thomas Cromwell, the 1st Earl of Essex (c. 1485-1540), Henry VII's politically astute but ultimately ill-fated Privy Councillor.

This book is the earliest printed lapidary in the English language. Lapidaries are books about stones. They often contain much information on the supposed properties and virtues of precious and semi-precious gems. Particularly popular in medieval times, they are represented by numerous manuscripts and were the subject of numerous incunabulae.[12] The question arises as to whether the volume under consideration can be linked to any of the popular western lapidaries from the 11th century onwards. The conclusion drawn here is that it represents a previously unknown English prose version of *The Lapidary of Sidrac*, extracted from one of the long manuscript versions of the original Old French work. The bases of this conclusion are:

1. A careful direct comparison of the English text with the most accessible published version.[13]
2. Direct comparison with the Old French text in a manuscript version.[14]
3. The list of included stones, some of which are unique to the Lapidary of Sidrac.[15]

This conclusion also infers that an otherwise unknown English prose translation of part or all of *Le livre de Sidrac* was in circulation during the first half of the 16th century.

Medical lore of the stones

Of the 24 stones cited in the text, 20 have medical applications associated with them; all have some magical properties ascribed to them, including such marvellous qualities as being able to counteract witchcraft and sorcery, to confer special personal characteristics to the bearer, or to resist temptation. These special virtues are envisaged as originating from the grace of God and, invested in the stone, are appropriated by consecrated, righteous living. Indeed, a number of stones are asserted as being derived, by floods of water, from 'Paradyse terrestre', a title which refers to the choice, central part of the Garden of Eden.[16] Many of the virtues can be

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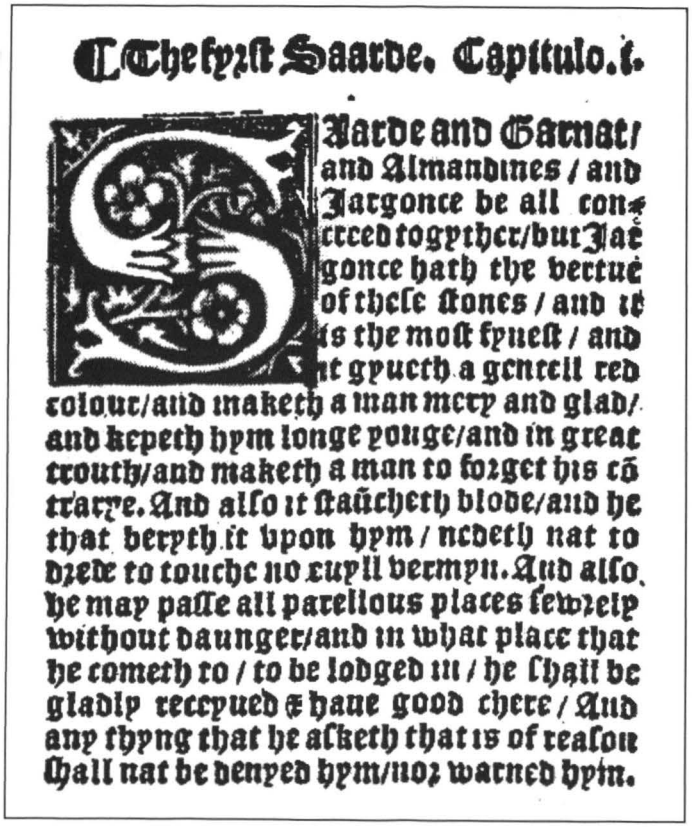
interpreted in terms of sympathetic magic, where correspondence between some feature of the material (often shape or colour) and of the disease it was used to treat determined its mode of employ (e.g. red gems used in the treatment of bleeding).

It has been suggested that the *Lapidary of Sidrac* was partly inspired by the earlier lapidary of Marbode, Bishop of Rennes (c. 1035-1123), probably written around 1090, and possibly also by unspecified 'eastern sources' which influenced the remainder of the text of *Le Livre de Sidrac*.[17]

The exact identity of many of the stones considered in the lapidary is open to discussion, partly because the rudimentary means of identifying minerals in classical and medieval times depended upon often unreliable, highly variable characteristics (such as colour), and other qualities which were, at best, relative measurements. Much synonymy, as well as huge nomenclatural variation and etymological evolution, combined with occasional copying errors and fabrications from one author to another adds another layer of complexity. The most likely identifications will be given, where such suggestions can be made, in the discussion below.

1. ***Sard***: this translucent brown, unbanded mineral is a type of agate, which is a cryptocrystalline form of silica. *Sidrac* states that it is part of a group also containing 'Granat' (garnet), Almandine (a reddish-purple mineral of the garnet group) and 'Jargonce' (usually taken to be yellow or green zircon). *Sidrac* indicates that it preserves youthfulness and is haemostatic (staunches bleeding). When worn as an amulet, the bearer 'nedeth nat to drede to touché no evyll vermin' – it presumably protected from bites, venom and possibly picking up parasites. The text entry for this stone is illustrated in Fig. 2.


¶ The fyrst Saarde. Capitulo. i.

Saarde and Garnat/ and Almandines / and Jargonce be all con- creed togyther/but Jar gonce hath the vertue of these stones / and it is the most fynest / and it gyueth a gentell red colour/and maketh a man mery and glad/ and kepeth hym longe youge/and in great trouth/and maketh a man to forget his cō trarye. And also it stauncheth blode/and he that beryth it vpon hym / nedeth nat to drede to touche no evyll vermyn. And also he may passe all parellous places fewrely without daunger/and in what place that he cometh to / to be lodged in / he shall be gladly receyued & haue good chere / And any thyng that he asketh that is of reason shall nat be denyed hym/nor warned hym.

Figure 2. Text entry for Sard (Cap. 1 of the *lytell booke of the. xxiiii. Stones pryncipalles)* from Plomer (1897).[9]

2. ***Topaz***: currently, this name refers to an aluminosilicate, but in the past it is possible that almost any yellow gem was meant. *Sidrac* indicates its use in cases of 'fye', an ancient French term whose meaning is obscure. The phrase 'who so euer haue this fye and serue it about with a Topace stone it shall neuer growe more' suggests that it might be a tumour or other excrescence. The same disease is referred to as 'fyc' in *Le Lapidaire du Roi Philippe*, 'fis' in the London Lapidary, 'fey' in the Peterborough Lapidary and 'fyes' in the Sloane Lapidary.[18] This may be the same as 'le fiel' in the 14th century lapidary of John Mandeville,[19] translated by one author as 'le maladie des bovins' – a cattle disease.

3. ***Emerald***: This gemstone variety of the aluminosilicate mineral beryl is coloured bright green by traces of chromium and sometimes vanadium in the crystal lattice. Sidrac explains that it heals otherwise unspecified diseases of the heart ('likenesse of the hert'), is effective against gout and 'longe sycknesse', by which protracted periods of illness is presumably meant.

4. ***Ruby***: This deep red gemstone variety of the aluminium oxide, corundum, is hailed by *Sidrac* as 'lorde of all stones'. It supposedly has a veterinary application – 'And if any beest be sycke & drynke of the water that the Rubye is put in it shall heale hym'. In addition, it contributed to a person's overall state of health in that it 'fedeth a mans sight & comfortheth the hert & the body'.

5. ***Sapphire***: This blue variety of corundum was esteemed by *Sidrac* as an antivenin, as well as being useful in the treatment of inflamed and festering sores ('boches' and 'rankles'), swellings, fevers, aches and pains (physical and mental), and jaundice. Treatment involved drinking the water in which the ruby had been steeped. In addition, if placed on the eye, it was believed to remove any 'fylth & make a bodyes iyen fayre & clere', as well as healing the condition known as Web-Eye (caligo – obscurity of the vision due to an opaque object in the tissues of the eye or eyelid).

6. ***Jasper***: This form of chalcedony comes in a wide variety of colours, but commonly red, brown and green. The red form was undoubtedly important, 'to staunche blode of hym that hath good byleue in god and staunche a body also of the blody meneson [dysentery] & of the feuers & of the Dropsye. ... And also this stone is good and profitable for a woman that traueyleth with chylde'.

7. ***Ligure***: Also known as Lyncurium, Lapis Lincis or the Lynx Stone, this is a stone whose identity has been much debated: amber, tourmaline, zircon and sapphire have all been proposed as mineral candidates, while fossil belemnites appear under this name in geological material medica collections from the 18th century.[20] *Sidrac* asserts that carrying the stone is good for jaundice, gout, melancholy and stomach problems, as well as being an effective haemostatic, especially in cases of dysentery.

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More generally, it 'stauncheth the bloode of mans membres in what place that ever it be on a man that bledeth'. In addition, it was believed to bring down high temperatures if placed in the mouth, and to cure diseases of the eye if touched against the eye itself.

8. Agate: Agates are brightly coloured, banded or variegated varieties of cryptocrystalline silica, usually of chalcedony. Named by Theophrastus (c. 371- c. 287 BC) from specimens collected from the River Achates (now Dirillo) on Sicily, Sidrac recommended agate as a geriatric medicine: 'The verry fyne and trewe Acate saueth & comforteth an olde man and sleketh his thurste and maketh hym stronge agayne and kepeth a body from venym and from the bytyng of Serpentes and other wode bestes'.

9. Amethyst: *Sidrac* gives only passing mention of the well-known property of this purple variety of quartz for preventing drunken-ness.

10. Onyx: banded chalcedony was suggested by Sidrac as being generally efficacious for preserving good health.

11. Beryl: This is a beryllium-rich aluminosilicate, one variety of which is emerald (see [3] above). Drinking the water in which this gem had been soaked was seen as being 'good and holsome for many dyuers syckenesses and who so be in good beleue and ... specially for the feuers and for the heed and for the heate that is in a mans stomake of any syknesse'.

12. Diamond: The impressive qualities of 'Dyamant', especially its hardness, led to the opinion that 'God gave unto this Diamante great grace and many vertues'. *Sidrac* summarised the perceived medical virtues as providing protection from poisons, and it 'kepeth a mans bones & his members hole & safe'.

13. Dyane : This unidentified mythical stone is unique to *Sidrac*, who says it develops in the stomach of a fish over a period of 300 years before being cast upon the shore by the sea. The haemostatic qualities of the stone could be exploited by touching upon open and bleeding wounds and cases of nosebleed. If the patient were to drink water, wine or any other 'lycour' which this stone has come into contact with, he would be cured of internal bleeding and any haemorrhage associated with the passing of bladder stones. Touching the stone against the eyes would supposedly bring relief from bloodshot eyes associated with strokes or other sicknesses.

14. Soryge: Another mythical stone unique to *Sidrac*, the Soryge originates in an animal that has much in common with the unicorn legend. Placing its head in the lap of a maiden, the animal is slaughtered for the stone, which is harvested from its mouth by hunters hiding nearby. Drinking only the water touched by this stone for a period of nine and a half days ensures freedom from the ravages of gout for a full year. Furthermore, it could be used 'for the syckenesse of the stomacke and for the humours of a mans body & against all wode beestes and the bytyngs of other vermyns and venomous beestes'.

15. Crasnuf : A further stone found only in *Sidrac*; contemplating the Crasnuf both morning and evening preserved a man from suffering sudden death; 'And if a man be wounded and beare this stone upon hym his wounde shall neuer rankle nor haue euyll smell nor shall nat be in no peryll therof' – the stone could also preserve wounds from festering and becoming gangrenous.

16. Vermidor: Found only in *Sidrac*, this stone was supposedly 'good against all maner of maladyes & syckenesses of a mans body/ for al lemires markes/ that is serued with this stone it consumeth it/ and departeth it'. The Italian translation of the text indicates that the phrase rendered here as 'lemires markes' refers to diseases of the heart and body.[21]

17. Reflambyne: The yellow colour of this stone indicated its efficacy in cases of jaundice, the treatment for which was drinking water touched by this stone twice a day for three days. The stone could also slake thirst and improve the strength and vitality of the bearer: 'it shall comforte greatly his members all that be on his body/ and shall gyue hym great force/ and strength a mans light greatly'. It has been suggested that Reflambyne, whose name is unique to *Sidrac*, is actually a misreading of 'elambari', the Arabic word for amber.[22] This proposition makes a great deal of sense considering the colour of the stone, its supposed virtues, and the fact that the author drew upon Arabic sources elsewhere in the volume.

18. Cocrice: Another stone found only in *Sidrac*, specimens were supposedly collected by smearing pieces of goat meat with honey and then throwing them into the rocks below the mountains. Cocrice stones stuck to the honey-coated flesh and could then be retrieved by hunting the birds that descended into the valleys to collect the pieces of goat. If the stone was touched against the eye twice a day for three or four consecutive days, it would supposedly cure eyes afflicted by the presence of 'perle that commeth often tymes of the poxes/ or of other diseases'. This could refer to cataracts or perhaps corneal cysts. In addition, the stone could expel poison from the body and protect the bearer from all types of vermin and 'venymous beest'.

19. Turquoise: The distinctively blue to green 'Turkays' stone is a hydrated copper phosphate. Carrying this stone ensured that 'shall neyther metes nor drynkes hurt hym nor do hym harme'.

20. Magnetite: 'Adamounde', used for this entry in *Sidrac*, is a synonym for diamond. This entry differs somewhat from that for 'Dyamant' (see above) in terms of the therapeutic virtues indicated, however. Esteemed as being good for dropsy when taken in a drink, its most celebrated use was as an intensely magnetic ingredient in a weapon salve, a property indicating some confusion with the iron oxide mineral Magnetite, the Lodestone. The text runs as follows :

> Also surgyons that knoweth the virtue of this sayd stone/ doth breke it to powder when that a man is hurt with a spere/ quarell/ arrowe/ or gonne pellet/ that the yron or stele byde in their body/ then they make a tent/ & myxte the salue with the powder of the stone/ & put the tent into the hole/ where the yron or stele is in: & so by the great virtue that this powder

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hath/ it draweth the yron or stele out/ & so they make the man hole.

Conclusions

In an attempt to identify the possible origins of some of the medical folklore contained in *Sidrac*, the entries were compared with a number of texts both predating the ancient French lapidary, and immediately following it.

The older sources relevant to a discussion of the stones included in *Sidrac* include Dioscorides' first-century *Materia Medica*, Pliny the Elder's *Historia Naturalis* ('Natural History', circa AD 77), Damigeron's second century *De Virtutibus Lapidum* ('The Virtues of Stones'), the *Etymologiarum* of Isidore of Seville ('Etymologies', early 7th century), the *Physica* (12th century) of Hildegard von Bingen, Bartholomaeus Anglicus' *De Natura Rerum* ('On the Nature of Things') written during the 1240s, Vincent de Beauvais' *Speculum Naturale* ('Mirror of Nature', mid-thirteenth century), the *De Mineralibus* (circa 1242) of Albertus Magnus, and Alfonso X el Sabio's mid-thirteenth century work entitled *Il Lapidario*.[23] It is obvious from Table 1 that there is no clear pattern of similarity between older works and the *Lapidary of Sidrac*; some of the therapeutic properties ascribed to certain stones have been cited by classical and early mediaeval authorities. The greatest similarity is shown between *Sidrac* and Marbode's Lapidary, *De Mineralibus* and *De Natura Rerum*, especially in respect of Jasper, Ligure and Agate; these authorities had the greatest influence on the writer of *Sidrac*, but the correspondence is by no means exact, and numerous properties cited by these and other early authors are omitted entirely from the popular French work. Ligure, for example, was often cited as an effective treatment for kidney and bladder stones, while Topaz has been claimed as a useful remedy against haemorrhoids and lunacy.

There are two lapidaries which are almost contemporaneous with *Sidrac*: *Le Lapidaire du roi Philippe* is known from around 11 manuscripts and is believed to date from the late 13th century, while the lapidary ascribed to the enigmatic John Mandeville is from the 14th century.[24] The former of these two lapidaries is the closest match to *Sidrac* (Table 1).

Potentially derivative works that have been examined are the various English medieval lapidaries; the London Lapidary, North London Lapidary and Peterborough Lapidary all date to the 15th century, whilst the Sloane Lapidary is 16th century. Table 1 shows a much greater consonance between these lapidaries and *Sidrac*, but not all of the comments in *Sidrac* have been repeated. In some examples (e.g. sapphire, jasper, ligure) the match is very good, and in some cases, the therapeutic properties are presented in a sequence almost identical to that in *Sidrac*. Once again, however, additional qualities appear in the English lapidaries.

The most significant and accessible early medieval Arabic works on precious stones include the *Kitab al-Jamahir fi Ma'rifat al-Jawahir* ('The Book Most Comprehensive in Knowledge on Precious Stones') of Al-Biruni (Abu al-Rayhan Muhammad ibn Ahmad al-Bıruni, or Alberonius in Latin; 973–1048), and the slightly later *Azhar al Afkar fi Djawahir al Ahdjar* ('Best Thoughts on the Best Stones') by Ahmad ibn Yusuf al-Tıfachi (1184–1253).[25] An examination of these texts for medical lore associated with precious stones has yielded no significant overlap with that in *The Lapidary of Sidrac.*

Thus, the *Lapidary of Sidrac* is interesting for several reasons; (1) like other lapidaries, it is a source of otherwise lost medical folklore, (2) it occupies an intermediate temporal position between the writings of classical authors plus early medieval encyclopaedists and the later, fully established, English lapidary tradition, (3) its content is likewise intermediate, containing some elements from earlier authors, but having much closer ties to contemporary and later lapidaries, whose content it might have influenced to some degree, (4) it contains some unique medical lore and information on a number of therapeutic stones exclusive to itself, reflecting the influence of other, as yet unidentified sources.

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Table 1. Table to illustrate the distribution of the therapeutic qualities of various stones identified in *The Lapidary of Sidrac* through the works of earlier authorities and later English medieval lapidaries. (Y) indicates that virtue is present in the work. Additional virtues recorded in the comparative works are not included.

Lapidary of Sidrac (late 13th century)		1st century to 13th century works										13th-14th century lapidaries		15th-16th century lapidaries			
Stone	Virtue	Dioscorides	Pliny	Damigeron	Isidore	Hildegard von Bingen	Vincent de Beauvais	Albertus Magnus	Bartholomaeus Anglicus	Alfonso X el Sabio	Marbode of Rennes	Lapidary of Jean Mandeville	Lapidaire du roi Philippe	London Lapidary	North Midland Lapidary	Peterborough Lapidary	Sloane Lapidary
Sard	Preserves youthfulness							Y	Y				Y				
	Haemostatic																
	Protects against vermin												Y	Y			
Topaz	Protects against 'fye'											Y	Y	Y		Y	Y
Emerald	Heart disease					Y											
	Gout												Y	Y		Y	Y
	Long sickness'																
Ruby	Veterinary												Y	Y	Y	Y	Y
	Improves sight												Y		Y		
	Comforts heart and body												Y	Y	Y	Y	
Sapphire	Sores and swellings			Y				Y	Y		Y			Y	Y	Y	Y
	Fevers							Y	Y		Y	Y		Y	Y	Y	Y
	Aches and pains										Y				Y		Y
	Jaundice												Y				
	Ocular problems			Y		Y			Y		Y	Y	Y	Y		Y	Y
	web-eye																
Jasper	Haemostatic							Y	Y			Y	Y	Y	Y		Y
	Dysentery												Y	Y	Y		Y
	Fevers							Y	Y			Y	Y	Y	Y	Y	Y
	Dropsy							Y	Y			Y	Y	Y		Y	Y
	Childbirth	Y				Y		Y	Y		Y	Y	Y	Y	Y	Y	Y
Ligure	Jaundice		Y					Y	Y				Y	Y	Y	Y	
	Gout												Y	Y	Y	Y	
	Melancholy												Y	Y		Y	
	Stomach problems					Y		Y			Y	Y	Y	Y	Y	Y	
	Haemostatic												Y	Y		Y	
	Dysentery							Y			Y		Y	Y	Y	Y	
	Reduce fevers												Y	Y		Y	
	Eye diseases												Y	Y		Y	
Agate	Strengthen the aged										Y	Y	Y	Y	Y	Y	
	Slakes thirst		Y					Y	Y			Y		Y			
	Protects from poisons			Y		Y		Y	Y		Y	Y	Y	Y	Y	Y	
	Protects from venomous beasts		Y	Y								Y	Y	Y		Y	
Amethyst	Prevents drunkenness		Y				Y	Y	Y		Y	Y			Y		Y
Onyx	Maintains good health													Y	Y		Y
Beryl	Cures 'divers sicknesses'			Y													Y
	Fevers											Y	Y	Y	Y		
	Problems of the head																
	Stomach problems							Y				Y					
Diamond	Protects from poisons				Y		Y				Y	Y	Y	Y	Y	Y	
	General health											Y	Y	Y	Y		
Tourquoise	Food poisoning																
Magnetite	Dropsy							Y	Y		Y	Y	Y	Y	Y		Y
	Weapon salve								Y			Y					
Number of matched entries		1	4	5	1	5	2	15	14	0	12	19	29	30	22	22	15

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Common Types of Diabetic Dosage Forms in Medieval Persia

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The story of diabetes mellitus is a remarkable chronicle covering around 3,500 years of medical history. In medieval times Persian physicians carried out extensive literary and clinical research on the diagnosis and treatment of diabetes. They tested various types of dosage forms to treat diabetic patients. In this article the most common diabetic formulations and their general considerations, which were repeatedly experienced by traditional Persian scholars during 9th-18th centuries AD, are studied. These formulations are divisible into two categories: oral and non-oral forms. The most common oral dosage forms include tablets (*Qors*), soaked drugs (*Naqoo*), decoctions (*Matbookh* or *Tabikh*), and mixed powders of drugs (*Sofoof*), while the most common non-oral dosage forms include inhalant drugs (*Shomoom*), solutions that the patient sits in (*Abzan*), ointment-like drugs (*Zemad*), enema solutions (*Hoqneh*) and suppositories (*Shiaf*). These findings reveal a part of the history of pharmacy in the medieval period.

Interest in medicines has been universal and changeless since the beginning of man.[1] Traditional Persian Medicine (TPM) consists of the sum total of all the knowledge and practices used in diagnosis, prevention and elimination of diseases in Persia from ancient times to the present. It is based entirely on practical experience and observations passed down from generation to generation.[2] It seems that Persian scholars first conceived the theory of humours and it later became a world-wide theme of medicine.[3] This theory was based on the four humours (blood, phlegm, black bile and yellow bile), which were the basis of diagnosis and treatment at that time.[4] Wherever civilisation arises we find 'pharmacy' because it fulfills one of human's basic needs.[5] The history of pharmacy in Persia goes back many centuries. Among the oldest pharmacy documents of ancient Persia, one can mention the holy book of Avesta as well as the *Dinkard*, the *Vazidegiza-i-Zadsperam*, and the memories of some Greek historians.

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It is interesting to mention that the term 'Drug' is probably derived from the Avestan ancient term '*Darav*' meaning the stem of a plant (*Dar* in Persian means tree). This word later changed into '*Darug*' in ancient Persian and then to '*Droga*' in Latin, '*Drogue*' in French, '*Dru*' in English and '*Daru*' in Persian. According to Edward Brawn:

> The most cogent evidence for ancient Persian interest in pharmacy is the Persian origin of many drug names in medieval medicine.[6]

The most famous documents among pharmaceutical books written by the Persian scientists are *Qarabadin* books, which are traditional pharmacopeias describing the preparation methods and procedures of compound medications. They include lists of the names of drugs, formulations or prescriptions.[7] For example, one of the famous pharmacists in *Jundishapur* academic centre (one of the earliest Persian universities in the Sassanid era) was *Shapur Sahl*. He composed his *Aqrabadin (*or *Qarabadin) Kabir* (great pharmacopeia) in 869 AD; it became the first formulary to receive widespread acceptance and use in hospitals and pharmacies of the time.[8,9] The design of the formulations in *Qarabadins* varies from author to author. Various dosage forms with different routes of administration were mentioned in those books,[7] including diabetic drugs.

The story of diabetes mellitus is a remarkable chronicle covering around 3500 years of medical history. The word 'Diabetes' is derived from a Greek term, which was first used by *Aretaeus* (81-138 AD) in 138 AD. Later, *Galen* (129-199 AD) researched this disease and described it as a renal disease. Persian physicians have carried out extensive literary and clinical research about diagnosis, complications, treatments and drug dosages for diabetes. The term *Ziabetes* in Persian, was used by early Persian scholars to define and describe what is currently called diabetes. In the TPM view diabetes may result from an imbalance in the kidney temperament as well as the whole body. Regarding this abnormal temperament, the disorder was categorised into two main types as hot (*Ziabites-e-har*) and cold (*Ziabites-e-barid*). The hot type was significantly more prevalent than the cold one and caused by an abnormal hot and dry temperament in the kidneys and all the body. The most important signs of both types of diabetes were unusual and excessive thirst, frequent urination and weight loss. In the cold type, thirst was mildly less than the hot type. Persian traditional scholars explained several dosage forms of drugs and therapeutic methods for diabetes.[10-13]

In this study, these dosage forms along with their special formulations and general considerations in medieval Persia are represented and introduced to clarify pharmaceutical knowledge of the drugs and therapeutic methods for diabetes in the medieval period as a part of the history of pharmacy.

Materials and Methods

The research method employed in this article is based on the analysis of the main remaining manuscripts of medieval Persia from 9th to 18th century AD including medical and pharmaceutical textbooks of this era, including *Al-Hawi fi al-Teb* [*Liber Continent*] of Razes (860-925 AD), *Hidāyat al-Muta'allimin fi al-Tibb* [The Students' Handbook of Medicine] of *Abubakr Akhawayni Bukhāri* (10th C AD), *Qanoon fi al-Teb* [Canon of Medicine] of Avicenna (980-1037 AD), *Zakhireye Kharazmshahi* [Treasure of the Khwarazm Shah] of *Ismaiel Jorjani* (1041-1136), *Kholasat-al-Tajarob* of *Baha-al-Dolah Razi* (16th C), *Tohfat-al-Momenin* of *Mohmmad Momen Tonekaboni* (17th C), *Mofareh-al-Gholoob* and *Teb e Akbari* of *Akbar Arzani* (17-18th C), *Makhzan-al- Advieh* and *Qarabadin Kabir* [Great pharmacopeia] of *Mohammad Hossein Aghili Khorasani* (18th C) and *Exir Azam* [Great Elixir] and *Qarabadin Azam* [Azam Pharmacopeia] of *Mohammad Azan Khan Chasti* (18th C).

The chapters containing information about diabetes were investigated and the data was collected, categorised and analysed. Then the types of dosage forms prescribed in diabetes by Persian scholars and their definitions and general considerations were researched.

Results

In Traditional Persian Medicine (TPM) references, especially in *Qarabadins*, there are several formulations and therapeutic methods for the treatment of diabetes. These formulations are divisible into two categories: oral forms and non-oral forms. The most common oral dosage forms include tablets (*Qors*), soaked drugs (*Naqoo*), decoctions (*Matbookh* or *Tabikh*), and mixed powders of drugs (*Sofoof*). The most common non-oral dosage forms include inhalant drugs (*Shomoom*), solutions that the patient sits in (*Abzan*), ointment-like drugs (*Zemad*), enema solutions (*Hoqneh*) and suppositories (*Shiaf*)[11, 14] (Table 1).

Oral forms

Qors (Tablet)

In *Qarabadin* books, *Qors* is usually defined as a storage dosage form; but sometimes (such as in the case of diabetic drugs) this term used for a pill (*hab* in Persian) and defined as a solid dosage form, prepared in a small round shape for a specific dose of drug.[15] When making this form of drug, traditional scholars triturated the ingredients together and mixed the powder with proper herbal extracts and then divided and formed the resulting paste into round-shaped tablets.[11-13, 16-17] Traditional scholars believed that the best time to use *Qors* was two years after date of production. After that, the drug would be expired.[14] *Qors* is more potent than *sofoof*.[15]

Naqoo

Naqoo are liquid dosage forms which are obtained by soaking drugs in water or other liquid and filtering them later without boiling.[14,18] Penetration of *Naqoo* in the body is more than for *Matbookh* and it is recommended that drugs and herbs used in the *Naqoo* should be semiground, not be broken roughly, and soaked in the water or other liquids for 2-3 days.[14] This point is emphasised in the preparation of *Naqoo-e-Tamrehendi* (tamarind) in diabetes.[20]

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Table 1. Examples of diabetic dosage forms in TPM

Type of dosage form		Example
Oral	*Qors*	***Qors-e-Tabasheer*:** Common Purslane seed, Damask rose flower, Pomegranate flower, Indian Thorny Bamboo dried exudates on node and Lettuce seed are ground and sifted and then mixed with apple, cucumber or sour pomegranate juice. Then the paste obtained is divided and formed into round shape (pill) and dried.[11-13]
	Naqoo	***Naqoo-e-Tamrehendi:*** Tamarind soaked in water (19-20)
	Matbookh/ Tabikh	***Matbookh* by *Yoḥanna ibn Māsawayh,*** (one of the famous physicians of *Jondishpour* (9th century AD)**:** Myrtle seed, Damask Rose flower, Somac, Pomegranate flower, Barberry, Azarole fruit mixed with sour apple or sour pomegranate juice after decoction.[21]
Non-oral	*Sofoof*	***Sofoof-e-Ziabetus:*** Dried Coriander, Damask Rose flower, Indian Thorny Bamboo dried exudates on node, dried Purslane, Pomegranate flower, Lettuce seed, Arabic gum and Camphor are ground and mixed together.[11]
	Shomoom	***Shomoom*** of Camphor.[12]
	Abzan	*Abzan* of cold water.[11,12]
	Zemad	***Zemad* for use on diabetic patients kidneys:** Lentil flour mixed with Rose water.[23]
	Hoqneh	**Rectal *Hoqneh*:** mixture of Almond oil, Pumpkin oil and fresh milk.[11,12,16]
	Shiaf	Suppository of ice[24]

Table 2. Scientific names of herbal drugs mentioned.

Persian name	Common name	Scientific name
Khorfa	Common purslane	*Portulaca oleracea* L.
Gol-e-Sorkh	Damask rose flower	*Rosa x damascena* Mill.
Golnar	Pomegranate (flower)	*Punica granatum* L.
Tabasheer	Indian Thorny Bamboo (dried exudate on node)	*Bambusa bambos* (L.) Voss
Kahoo	Lettuce	*Lactuca sativa* L.
Tamrehendi	Tamarind	*Tamarindus indica* L.
Moord	Myrtle	*Myrtus communis* L.
Somaq	Sumac	*Rhus coriaria* L.
Amberbaris	Barberry	*Berberis vulgaris* L.
Zaaroor	Azarole	*Crataegus azarolus* L.
Geshniz	Coriander	*Coriandrum sativum* L.
Samq-e-Arabi	Arabic gum	*Acacia arabica* (Lam.) Willd.
Kaphoor	Camphor	*Cinnamomum camphora* (L.) J.Presl.
Adas	Lentil	*Lens culinaris* Medikus
Badam	Almond	*Prunus dulcis* (Mill.) D.A.Webb
Kadoo	Pumpkin	*Cucurbita pepo* L.

Matbookh/Tabikh

Matbookh and its synonym *Tabikh* are liquid dosage forms which are obtained from a decoction of herbal drugs. In *Matbookh* form, dregs of drugs should be filtered off immediately after decoction, or else the potency of *Matbookh* decreases.[14]

Sofoof

Sofoof is a dry mixture of triturated drugs. In TPM, it is the best dosage form for kidney and liver disorders.[14-15] Thus it was commonly used in diabetes, which was believed to be an abnormal temperament of the kidneys. In making sofoof, the ingredients were ground into very fine and powdery particles and then prescribed for diabetic patients to eat with proper fruit juice.[11] Traditional scholars believed that the best time to use Sofoof was 2-6 months after the production date. After that, the drug would have expired.[14]

Non-oral forms

Shomoom

Shomoom are inhaled drugs, either solid or liquid.[22]

Abzan

Abzan is a basin full of water or decocted herbal drugs in which the patients sits. Traditional scholars believed that the water of diabetic *Abzan* should surround the kidneys of patients.[22] They also said that sitting in cold *Abzan* strengthens bladder muscles and chills abnormally hot kidneys of diabetic patients.[12]

Zemad

Zemad are soft thick liquid dosage forms which are daubed on various parts of a patient's body depending on the type of disease.[14,15] In diabetic *Zemad* form, after daubing on the kidneys, the effective and potent part of the drug penetrates and influences the kidneys.[12] Occasionally *Zemad* was prescribed for patients who could not tolerate oral drugs.[25]

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Hoqneh

Hoqneh is one of the therapeutic procedures in which a liquid form drug is introduced into the rectum and colon via anus or into the uterus via vagina (rather like an enema).[22] In TPM, *Hoqneh* is one of the safest and most efficacious therapeutic methods; it is used to excrete waste and unnecessary materials from the body and affects gastrointestinal and kidney diseases. *Hoqneh* should not be performed in very hot weather[12] or when the patient is hungry or very tired.[25] The liquid drug introduced into the rectum, should be moderately warm; its composition was different in various disorders. It was used with cold temperament herbs and drugs in diabetic *Hoqneh*.[11-12]

Shiaf

Shiaf (suppository) is defined as a solid dosage form that is prepared in a biconvex shape for insertion in the rectum.[12, 14]

Conclusions

History reveals that diabetes has always been a part of medical research and discussion, although in a very primitive form in the ancient ages. In the medieval ages the Persian physicians carried out extensive literary and clinical research on the diagnosis and treatment of diabetes. Various diabetic formulations were used in medieval Persia from the 9th to 18th century. The number of diabetic formulations was increased during that time but dosage presentations remained the same. It seems that the emphasis on the properties of drugs and adverse or toxic effects following the use of these formulations was not neglected by Persian scholars, and it is not possible that the formulations could have been used continuously throughout history with no therapeutic effects. Accordingly the pharmaceutical existence of diabetic formulations in the medieval era cannot be denied.

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Book Review

The British Pharmacopoeia, 1864 to 2014: Medicines, International Standards and the State by Anthony C Cartwright

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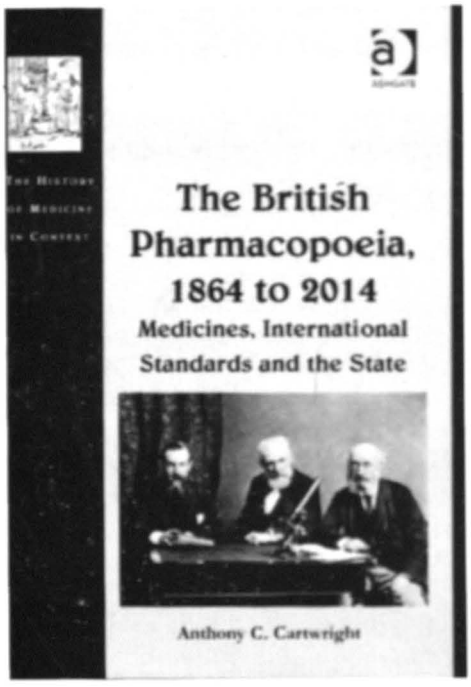
Also available as PDF and EPUB files.



The history forms part of Ashgate's 'History of Medicine in Context' series. Anthony Cartwright is well placed to write this history of the *British Pharmacopoeia*, on the occasion of its first 150 years. As a retired pharmaceutical regulatory consultant he had over 30 years' involvement with the *BP*, both on the staff and as a member of its advisory committees.

The three main parts cover: the origins, development and maturity; the *BP* in the international context; and change and continuity.

The history of pharmacopoeias, from the earliest papyri through city and state pharmacopoeias to the origins of the *BP* in the London, Edinburgh and Dublin pharmacopoeias of the 17th to early 19th centuries, forms the background to the first *BP* in 1864. The General Medical Council was given the task of compiling the pharmacopoeia until its Pharmacopoeia Commission passed to the Medicines Commission under the Medicines Act 1968.

There are detailed descriptions of how the succeeding pharmacopoeias were produced, with interesting sidelights on relations with its competitor the *British Pharmaceutical Codex*. For many years the Pharmaceutical Society acted as publisher of both books until HM Stationery Office took over. There are details of the editors and directors who ran the commission and produced the many editions, usually every five years, with annual *Addenda*. Financial considerations and the fact that far fewer *Addenda* were sold, so that many users were out of date, led to a change to annual editions from 1998. A CD-ROM format was also introduced.

Developments such as the *International* and *European Pharmacopoeias* have been strongly influenced by the *BP*, which has played a large part in the harmonisation of standards and the development of international approved names for drugs. The BP offices moved with the MHRA from Vauxhall to Victoria in 2010 while the BP Laboratory at Stanmore moved in 2005 to the Laboratory of the Government Chemist in Teddington.

One chapter surveys changes in therapeutics and summarises the origin and pharmacopoeial history of new classes of drugs and preparations, such as alkaloids, salicylates, vaccines, arsenicals, hormones, antibacterials, and cardiac drugs. Many of these have required the development of new methods of standardisation and a chapter describes developments in instrumentation, analytical techniques and biological standardisation.

The first *BP* used Imperial weights and measures for doses and for analysis and ignored proposals to use the metric cgs system, but slowly the metric system caught on and was introduced in 1885 for analysis and by 1914 for doses. A final changeover was made in 1963 after a century of discussion.

The author has been assiduous in documenting the decisions of the Commission and the work of its Directors and staff, that have made successive editions of the *BP* a leader in setting standards for the world's pharmaceuticals. Every pharmaceutical historian will find material of interest here.

Ainley Wade

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